September 2020

HYDROLOGY SPECIALIST REPORT FOR THE

Stanislaus National Forest
Prather-Medusa Forest Resilience Project

PREPARED FOR:

National Fish and Wildlife Foundation
and Stanislaus National Forest

Hydrology Specialist Report
of the
Stanislaus National Forest
Prather-Medusa Forest Resilience Project

Prepared For:

Stanislaus National Forest

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TABLE OF CONTENTS

Tables

LIST OF ABBREVIATIONS

AMS	Aquatic Management Strategy
BMP	Best Management Practices
CAR	critical aquatic refuges
CWA	Clean Water Act
CWE	Cumulative Watershed Effects
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
ERA	Equivalent Road Acres
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
FSEIS	Final Supplemental Environmental Impact Statement
FSM	Forest Service Manual
HCS	hydrologically connected segments
HUC	hydrologic unit code
IRA	Inventoried Roadless Area
NFIP	National Flood Insurance Program
NHD	National Hydrologic Dataset
NPDES	National Pollutant Discharge Elimination System
RCA	Riparian Conservation Area
RCO	Riparian Conservation Objectives
ROD	Record of Decision
SNFPA	Sierra Nevada Forest Plan Amendment
SPCC	Spill Prevention and Containment Countermeasure
SSI	Stanislaus Streamscape Inventory
STF	Stanislaus National Forest
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Loads
USGS	United States Geological Survey
WUI	Wildland Urban Intermix

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1 INTRODUCTION

The Stanislaus National Forest (STF), Calaveras Ranger District, is proposing to conduct forest resilience treatments in the area of Prather Meadows, Big Rattlesnake Creek, and Little Rattlesnake Creek. The project is located in the Calaveras Ranger District, in Tuolumne County, California, northeast of the community of Arnold and south of the community of Cabbage Patch, south of the North Fork Stanislaus River (Appendix A; Figure 1). The project area includes wildland urban interface zone (WUI), California spotted owl and northern goshawk habitat areas, general forest, fuel break, plantation, and aspen stand and meadow landscapes. The Carson-Iceberg Inventoried Roadless Area (IRA) exists on the northwestern edge of the project area.

The need for the project is to reduce improve resilience and decrease catastrophic fire risk by reducing fuel loadings; improve forest health from altered forest conditions that have resulted from nearly a century of fire exclusion policies and practices; and provide maintenance of system roads to access fuels treatment areas. To meet the needs of the project, STF is proposing a variety of vegetation treatment types in the various landscapes, as appropriate. These include mechanical thinning, salvage, biomass removal, prescribed burning, mastication, hand thinning, and fuel break construction and maintenance.

2 DESCRIPTION OF PROPOSED ACTION

2.1 Purpose and Need

The objectives of the Prather-Medusa Forest Resilience Project are to:

- Increase tree, stand, and landscape resiliency and sustainability by producing different stand structures and densities across the landscape, and enhance the general health of forested stands by reducing susceptibility to insect infestations, diseases, and drought-related mortality by improving and promoting stand and individual tree growth and vigor.
- Reduce future fire intensity and severity on federal land and adjacent private land by reducing surface ladder fuels, increasing the height to canopy, decreasing crown density, and retaining large, fire-resistant tree species.
- Maintain and enhance important wildlife habitat, mature forest ecosystem values, and connectivity of mature forest stands.
- Maintain and enhance the extent and connectivity of aspen stands by reducing encroaching conifers.

2.2 The Proposed Action

Refer to Chapter 2, “Proposed Action,” of the Prather Medusa Forest Resilience Project Environmental Assessment for a full description of the proposed action.

3 REGULATORY FRAMEWORK

3.1 United States Forest Service

Forest Service Manual and Forest Service Handbook

Forest Service Manual (FSM), Chapter 2500 addresses watershed management, the objective of which is 1) to protect and, where appropriate, enhance soil productivity, water quality and quantity, and timing of waterflows, and 2) to maintain favorable conditions of streamflow and a continuous production of resources from National Forest System watersheds.

The Forest Service Handbook (FSH) Region 5 Soil and Water Conservation Handbook (R5 FSH 2509.22, Supplement 22-2011-1) provides guidance for protection and improvement of water quality on National Forest System lands in California. This includes programmatic Best Management Practice (BMP) guidance for erosion control. The programmatic BMPs described in the handbook are intended to lead to site-specific BMP prescriptions but are not intended to be such prescriptions themselves.

Forest Service Region 5

Non-point source pollution on national forests is managed through the Regional Water Quality Management Plan (USDA Forest Service, Pacific Southwest Region, 2000), which relies on implementation of prescribed best management practices. The Water Quality Management Plan includes BMPs for timber harvesting, road building and maintenance, and protection of Riparian Conservation Areas. Working cooperatively with the California State Water Quality Control Board, the Forest Service developed pollution control measures, referred to as BMPs, that are applicable to National Forest System lands. The BMPs were evaluated by State Water Quality Control personnel as they were applied on site during management activities. After assessment of the monitoring data and completion of public workshops and hearings, the Forest Service's BMPs were certified by the State and approved by the U.S. Environmental Protection Agency (EPA) as the most effective means to control non-point source pollution.

The land treatment measures incorporated into Forest Service BMPs evolved through research and development measures and have been monitored and modified over several decades with the expressed purpose of improving the measures and making them more effective. On site evaluations of the control measures by State regulatory agencies found the practices were effective in protecting beneficial uses and were certifiable for Forest Service application as their means to protect water quality. The Clean Water Act provided the initial test of effectiveness of the Forest Service non-point pollution control measures by requiring evaluation of the practices by regulatory agencies (State Board and EPA) and the certification and approval of the practices as the "Best" measures for control.

BMPs are designed to accommodate site-specific conditions. They are tailor-made to account for the complexity and physical and biological variability of the natural environment. In the 1981 Management Agency Agreement between the State Water Resources Control Board and the Forest Service the State agreed that: "The practices and procedures set forth in the Forest Service document constitute sound water quality management and, as such, are the best management practices to be implemented for water quality protection and improvement on NFS lands." Further the Water Quality Control Plan for the Central Valley Regional Water Quality Control Board states "Implementation of

the BMPs, in conjunction with monitoring and performance review requirements approved by the State and Regional Boards, is the primary method of meeting the Basin Plan's water quality objectives for the activities to which the BMPs apply."

Stanislaus National Forest Land and Resource Management Plan

The STF *Forest Plan Direction* presents the current management direction, based on the 1991 Forest Plan as modified through the Forest Plan appeals amendment processes (USDA 2017). The land allocation in the Prather-Medusa project area relevant to hydrological resources is Riparian Conservation Area (RCA). The implementation of site-specific limitations on equipment operation, remediation of project-related and legacy soil compaction effects, road maintenance, BMPs specific to the project are intended to meet the Standards and Guidelines for RCAs consistent with the *Forest Plan Direction*. Applicable forest goals include:

Management of riparian areas is intended protect or improve riparian area-dependent resources while allowing for management of other compatible uses. The desired conditions for the project area are those identified for RCAs more generally in the STF *Forest Plan Direction* (USDA 2017). The following desired conditions have applicability to maintenance of riparian resources:

- Water quality meets the goals of the Clean Water Act and Safe Drinking Water Act; it is fishable, swimmable, and suitable for drinking after normal treatment.
- Habitat supports viable populations of native and desired non-native plant, invertebrate, and vertebrate riparian and aquatic-dependent species. New introductions of invasive species are prevented. Where invasive species are adversely affecting the viability of native species, the appropriate State and Federal wildlife agencies have reduced impacts to native populations.
- Species composition and structural diversity of plant and animal communities in riparian areas, wetlands, and meadows provide desired habitat conditions and ecological functions.
- The distribution and health of biotic communities in special aquatic habitats (such as springs, seeps, vernal pools, fens, bogs, and marshes) perpetuates their unique functions and biological diversity.
- Spatial and temporal connectivity for riparian and aquatic-dependent species within and between watersheds provides physically, chemically and biologically unobstructed movement for their survival, migration and reproduction.
- The connections of floodplains, channels, and water tables distribute flood flows and sustain diverse habitats.
- Soils with favorable infiltration characteristics and diverse vegetative cover absorb and filter precipitation and sustain favorable conditions of stream flows.
- In-stream flows are sufficient to sustain desired conditions of riparian, aquatic, wetland, and meadow habitats and keep sediment regimes as close as possible to those with which aquatic and riparian biota evolved.
- The physical structure and condition of stream banks and shorelines minimizes erosion and sustains desired habitat diversity.
- The ecological status of meadow vegetation is late seral (50 percent or more of the relative cover of the herbaceous layer is late seral with high similarity to the potential natural

community). A diversity of age classes of hardwood shrubs is present, and regeneration is occurring.

- Meadows are hydrologically functional. Sites of accelerated erosion, such as gullies and headcuts are stabilized or recovering. Vegetation roots occur throughout the available soil profile. Meadows with perennial and intermittent streams have the following characteristics: (1) stream energy from high flows is dissipated, reducing erosion and improving water quality, (2) streams filter sediment and capture bedload, aiding floodplain development, (3) meadow conditions enhance floodwater retention and groundwater recharge, and (4) root masses stabilize stream banks against cutting action.

The goals for aquatic, riparian, and meadow ecosystems are implemented through the identification of RCAs and the application of Riparian Conservation Objectives (RCOs) which protect beneficial uses of water bodies and the geomorphic, biological and hydrologic characteristics of aquatic features. A Critical Aquatic Refuge (CAR) is a small watershed that contain known locations of special status plant or animal species, highly vulnerable populations of native species, or localized populations of rare native aquatic or riparian dependent plant or animal species. There are no CARs identified within or downstream of the project area.

Riparian Conservation Areas

The Sierra Nevada Forest Plan Amendment (SNFPA), Final Supplemental Environmental Impact Statement (FSEIS), Record of Decision (ROD) (USDA 2004) and the STF 2017 Forest Plan Direction that the SNFPA amends (USDA 2010) requires that a site-specific project-level analysis be conducted to determine whether activities proposed within RCAs meet the RCOs identified as a part of the SNFPA Aquatic Management Strategy (AMS). The analysis must consider physical factors such as soil characteristics, geology, slope, and stream characteristics, as well as biological factors such as the presence of aquatic- and riparian-dependent species, their habitat needs, and the capability of the existing environment to provide needed habitat.

This document, in part, describes the activities proposed within RCAs that are associated with the Prather Medusa Forest Resilience Project alternatives and analyzes whether those alternatives meet applicable RCOs. The analysis determines which aspects of the AMS goals would be affected by the alternatives and recommends the type and level of activities that can occur within the RCAs. The analysis considers:

- the type and extent of the area affected by the alternatives,
- connectivity to adjoining landscapes,
- presence of special habitats, including critical aquatic refuges (CARs), if any, and
- the needs of riparian- and aquatic-dependent species or communities within the area affected by the alternatives.

The analysis considers management requirements for the protection of hydrological resources that have been incorporated into the Proposed Action as design features of the project.

RCAs “are land allocations that are managed to maintain or restore the structure and function of aquatic, riparian, and meadow ecosystems” (USDA 2004). The intent of the management direction for RCAs is to (1) preserve, enhance, and restore habitat for riparian- and aquatic-dependent species, (2) ensure that water quality is maintained or restored, (3) enhance habitat conservation

for species associated with the transition zone between upslope and riparian areas, and (4) provide greater connectivity within the watershed." RCAs are delineated and managed consistent with the RCOs defined in the ROD.

RCA widths vary depending on the type of water body (Table 1). The types of water bodies are designated as follows: (1) perennial streams; (2) seasonally flowing streams (includes ephemerals with defined stream channel or evidence of scour); (3) streams in inner gorge; (4) special aquatic features (lakes, meadows, bogs, fens, wetlands, vernal pools, and springs); and (5) other hydrologic or topographic depressions without a defined channel. The SNFPA ROD defines RCA widths as follows (USDA 2004):

Table 1 Sierra Nevada Forest Plan Amendment Record of Decision Land Allocations

RCA Designation Type	Width
Perennial Stream	300 feet measured from bank full edge
Seasonal Flowing Stream	150 feet measured from bank full edge
Streams in Inner Gorge (stream adjacent slopes >70% gradient)	Top of inner gorge if beyond 300 feet
Special Aquatic Features (lakes, wet meadows, bogs, fens, wetlands, vernal pools, and springs) or Perennial Streams with riparian conditions extending more than 150 feet from the edge of the streambank, or Seasonally Flowing Streams with riparian conditions extending more than 50 feet from the edge of the streambank.	300 feet from edge of feature or riparian vegetation, whichever is greater
Other hydrologic or topographic depressions without a defined channel	RCA width and protection measures determined through project-level analysis

3.2 Federal

Executive Orders

Floodplain management (11988)

Floodplain Management Executive Order 11988 (May 24, 1977) directs all federal agencies to evaluate potential effects of any actions it may take in the floodplain and to avoid all adverse impacts associated with modifications to floodplains. It also directs federal agencies to avoid encroachment into the 100-year floodplain, whenever there is a practicable alternative, and to restore and preserve the natural and beneficial values served by the floodplains.

The Federal Emergency Management Agency (FEMA) oversees floodplain management and runs the National Flood Insurance Program (NFIP) adopted under the National Flood Insurance Act of 1968. FEMA prepares Flood Insurance Rate Maps (FIRM) that delineate the regulatory floodplain to assist local governments with land use and floodplain management decisions to meet the requirements of the NFIP. In general, the NFIP mandates that development is not to proceed within the 100-year regulatory floodplain, if the development is expected to increase flood elevation by one foot or more. Very limited development is allowed in designated 100-year floodways (i.e., flood flow channels and areas with sufficient directional flow velocity of 100-year floodwaters).

Protection of Wetlands (11990)

Protection of Wetlands Executive Order 11990 (May 24, 1977) directs all federal agencies to evaluate the potential effects to wetlands in planning their actions; and to consider alternatives to wetland sites, and limit potential damage if an activity affecting a wetland cannot be avoided.

Clean Water Act

The U.S. Environmental Protection Agency (EPA) is the lead federal agency responsible for water quality management. The Clean Water Act (CWA) is the primary federal law that governs and authorizes water quality control activities by EPA as well as the states. The CWA provides for the restoration and maintenance of the physical, chemical, and biological integrity of the nation's waters.

CWA Water Quality Criteria/Standards

Pursuant to federal law, EPA has published water quality regulations under Title 40 of the CFR. Section 303 of the CWA requires states to adopt water quality standards for all surface waters of the United States. As defined by the act, water quality standards consist of designated beneficial uses of the water body in question and criteria that protect the designated uses. Section 304(a) requires EPA to publish advisory water quality criteria that accurately reflect the latest scientific knowledge on the kind and extent of all effects on health and welfare that may be expected from the presence of pollutants in water. Where multiple uses exist, water quality standards must protect the most sensitive use. As described in the discussion of state regulations below, the State Water Resources Control Board (SWRCB) and its nine RWQCBs have designated authority in California to identify beneficial uses and adopt applicable water quality objectives.

CWA Section 303(d) Impaired Waters List

Under Section 303(d) of the CWA, states are required to develop lists of water bodies that do not attain water quality objectives after implementation of required levels of treatment by point source dischargers (municipalities and industries). Section 303(d) requires that the state develop a Total Maximum Daily Load (TMDL) for each of the listed pollutants. The TMDL is the amount of the pollutant that the water body can receive and still comply with water quality objectives. The TMDL is also a plan to reduce loading of a specific pollutant from various sources to achieve compliance with water quality objectives. EPA must either approve a TMDL prepared by the state or disapprove the state's TMDL and issue its own. National Pollutant Discharge Elimination System (NPDES) permit limits for listed pollutants must be consistent with the waste load allocation prescribed in the TMDL. After implementation of the TMDL, it is anticipated that the problems that led to placement of a given pollutant on the Section 303(d) list would be remediated.

3.3 State and Local

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act provides for the protection of water quality by the SWRCB and the nine RWQCBs, which are authorized by the EPA to enforce the Clean Water Act in California.

Water Quality Control Plan

The Basin Plan presents water quality standards and control measures for surface water and groundwater of the region. The Basin Plan designates beneficial uses for waterbodies and establishes water quality objectives, waste discharge prohibitions, and other implementation measures to protect those beneficial uses. The Basin Plan contains both narrative and numeric water quality objectives for the region. Ambient water quality standards are set as objectives for a body of water and effluent limits (or discharge standards) are conditions in state or federal wastewater discharge permits, such as the NPDES permits. Land uses and activities that could degrade water quality and BMPs that could be used to address various nonpoint sources of pollution are identified in the Basin Plan.

Beneficial Uses

The Basin Plan defines and designates the existing beneficial uses for surface water and groundwater in the study area. Beneficial uses for receiving waters of the project study area are identified in Table 2.

Table 2 Designated Beneficial Uses for Waterbodies in the Study Area

Beneficial Use	Definition of Use	Stanislaus River – Source to New Melones Reservoir
Surface Water		
Municipal and Domestic Supply	Community, military, or individual water supply, including drinking water supply.	X
Agricultural Supply	Irrigation.	X
	Stock watering.	X
Industry	Hydropower Generation. Hydroelectric power generation.	X
Recreation	Contact Recreation. Recreational activities involving body contact with water where ingestion of water is reasonably possible. These include, for example, swimming, water-skiing, or fishing.	X
	Canoeing and Rafting. Recreational activities involving proximity to water, but not normally involving body contact with water. These uses include picnicking, sunbathing, hiking, beachcombing, camping, boating, and others.	X
	Other Noncontact Recreation. Recreational activities involving proximity to water, but not normally involving body contact with water. These uses include picnicking, sunbathing, hiking, beachcombing, camping, boating, and others.	X
Freshwater Habitat	Coldwater Habitat. Beneficial uses of waters that support cold water ecosystems including, but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates.	X

Beneficial Use	Definition of Use	Stanislaus River – Source to New Melones Reservoir
	Warm Water Habitat. Beneficial uses of waters that support cold water ecosystems including, but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates.	X
Warmwater Spawning, Reproduction, and Development	Uses of water that support high quality aquatic habitat necessary for reproduction and early development of fish and wildlife.	X
Wildlife Habitat	Uses of waters that support wildlife habitat including preservation and enhancement of vegetation and prey species such as waterfowl.	X
Groundwater – All Groundwaters of the Central Valley Region		
	There are no designated groundwater basins in the project area with identified beneficial uses in the Central Valley RWQCB Basin Plan.	

Source: Central Valley RWQCB 2018

4 METHODOLOGY

Evaluation of hydrologic and water quality impacts was based on a review of general and project-specific studies that document water resource and stream corridor conditions and address possible effects of the project. The information obtained from these sources was reviewed and summarized to establish existing conditions and to independently identify potential environmental impacts, based on the context and intensity factors identified above. This analysis assumes that the project would comply with relevant federal, state, and local laws and regulations.

To carry out the impact analysis and determine project-related effects, data relating to the type and location of water quality features in the project vicinity were collected, synthesized, and summarized. Information on drainage and wetland features was collected at a local level for the proposed action, and this information was used to establish how widespread disturbance impacts would be on riparian environments. These data were combined with watershed-level drainage information to provide an analysis of downstream effects on waterbodies. Local drainage and wetland information was collected from several sources, including a prior Stanislaus Streamscape Inventory (SSI) survey (USDA 2009), wildlife surveys, National Hydrologic Dataset (NHD) spatial data, topographic investigations, and satellite imagery. These data were combined to create a single dataset representing drainage features and connectivity in the area where the alternative alignments would cross. For the analysis in RCAs, aquatic features were further categorized based on their characteristics, and appropriate buffers were applied according to the SNFPA land allocations (USDA 2004). For the cumulative effects analysis, Forest Service Region 5 has developed a standardized methodology for evaluation of cumulative watershed effects (CWE) (FSH 2509.22). A CWE analysis typically combines the existing level of land disturbance with the

level of disturbance proposed under a project and compares it against a threshold level of concern for that watershed to evaluate the likelihood that a certain activity would result in significant effects. The CWE carried out for the proposed action is explained in more detail in Section 7.2, below.

As described in Section 2.2.4," Design Features," the project incorporates a list of management requirements designed to avoid and minimize environmental effects. These management requirements are considered part of the project by the Forest Service and are evaluated as such in this document. The text of management requirements related to the protection of hydrological resources is provided in Appendix B.

5 AFFECTED ENVIRONMENT

The elevation range of the watersheds within the project area is 4,100 feet at the confluence of Little Rattlesnake Creek with the North Fork Stanislaus River, up to 7,600 feet near Liberty Hill. In the lower, south facing slopes of the project area, vegetation is dominated by stands of mixed conifer forest, composed of a combination of incense cedar, sugar pine, Jeffrey pine, lodgepole pine, and white fir. On higher, north-facing slopes, red fir is the predominant tree species. Plantation forests are scattered throughout the project area, and while most were originally planted with Jeffrey pine, there is extensive natural growth of red fir in many plantations today.

5.1 Hydrology

The project area is in the North Fork Stanislaus River watershed, one of the four major rivers on the Stanislaus National Forest. The North Fork Stanislaus River forms the border between Tuolumne and Calaveras counties. Within the Stanislaus River drainage, the project is located in the North Fork Stanislaus and Highland Creek subwatersheds. Highland Creek is a tributary to the North Fork Stanislaus River. Watersheds for the project are delineated using the hydrologic unit code (HUC) system, a nested hierarchical approach for classifying and naming watersheds based on size and location (USGS and NRCS 2009).

The entire project area drains west and northward into the Middle North Fork Stanislaus River. It encompasses the drainage area for seven HUC 7 watersheds, based on the National Hydrologic Dataset (NHD). Those watersheds are the Whittles Upper Camp, Ganns, Hell's Kitchen, Boards Crossing, Lower Highland Creek, Upper Beaver Creek, and Middle Beaver Creek drainages (Figure 3.2-1). Prominent riparian and aquatic features of the watersheds that drain the project area are described below and shown in Appendix A; Figure 2.

North Fork Stanislaus River

The North Fork Stanislaus River is a 31.2-mile tributary of the Stanislaus River in the central Sierra Nevada mountains and Stanislaus National Forest of eastern California. It drains approximately 196 square miles, and flows to the north of the project area, from east to west. The North Fork Stanislaus River is a HUC 6 watershed; because of the relatively large size of North Fork Stanislaus River, the small number of treatment acres, and the position of the project high in the upper watershed, adverse effects to the North Fork Stanislaus River as a result of project activities are

expected to be below the level of detection. Therefore, this watershed level has not been evaluated for effects.

Whittles Upper Camp Watershed

Most of the project area—74 percent—lies within the Whittles Upper Camp watershed, drained by two creeks, Big Rattlesnake and Little Rattlesnake Creeks (Appendix A; Figure 2). These creeks generally flow in a westerly direction and are fed by lesser intermittent and perennial drainages. The most recent stream condition survey was conducted in 2009 on portions of Big Rattlesnake Creek. This survey followed the Stanislaus Streamscape Inventory (SSI) protocol (Frazier et. al. 2008) for stream morphology, condition, and health indicators. SSI is a field-intensive methodology for evaluating the existing condition of stream channels, aquatic resources, and riparian areas. Approximately 7,100 meters of Big Rattlesnake Creek was surveyed, from the bridge on FSTS road 6N17 to the upstream crossing at 6N08.

Big Rattlesnake Creek

The largest drainage in the project area, Big Rattlesnake Creek is in overall good stream health. There is some channel instability along various reaches within the project area; however, streambank stability is high along more than half of the creek reach, and moderate along approximately 35 percent of the reach. In 2013, a culvert along FSTS road 6N91 that had been a source of stream downcutting in Big Rattlesnake Creek was decommissioned in effort to reduce some of the downstream channel instability.

Stream shading along Rattlesnake Creek is high, measuring between 60 and 92 percent (Forest Service 2009) and adequate to maintain cool water temperatures (ranging between 10 and 15 degrees Celsius). During the 2009 SSI survey, rainbow trout of diverse sizes and age classes were observed, which indicates that the stream habitat is acceptable for fish spawning and rearing. Obligate riparian vegetation is sparse along most reaches, consisting primarily of alder, with isolated groups or individuals of dogwood, cottonwood, and aspen of various age classes. Non-obligate riparian vegetation is more abundant and is dominated by light to moderately dense stands of white fir, mixed conifer, red fir, and a small amount of lodgepole pine of various age classes.

Little Rattlesnake Creek

Little Rattlesnake Creek is in moderate stream health and appears to have been heavily modified from management activities in the surrounding watershed. Because of this, the channel has a high degree of channel instability, with incised and widened portions along significant portions of the stream. Sufficient stream shading along Little Rattlesnake Creek keeps water temperatures cool, and other physical indicators such as stream pool distribution, substrate size, and downed woody debris supply a quality of stream habitat sufficient to support an abundance of fish species of various age classes (USDA 2012). Obligate riparian vegetation occurs in greater densities than along Big Rattlesnake Creek, with montane riparian and aspen land cover classes along significant portions of the creek in the south-central part of the project area. Non-obligate riparian vegetation along the creek is characterized by Sierran mixed conifer, Jeffrey pine, and red fir, consistent with the general forest condition class within the project area.

There are 10 dispersed recreation sites along Big Rattlesnake Creek, and three dispersed recreation sites along Little Rattlesnake Creek. These sites are exhibiting signs of resource damage to various degrees, because of erosion and sedimentation, riparian disturbance, and lack of sanitation.

Ganns Watershed

Approximately 13.5 percent of the project area drains into the Ganns HUC 7. Within the project area, this watershed is drained by minor tributaries to the North Fork Stanislaus River. Lake Moran and Swamp Lake are two perennial lacustrine features of this watershed, located at the headwaters of these tributaries.

Lake Moran

Lake Moran is a popular destination for dispersed camping and off-highway vehicle use. The rocky, densely treed shoreline is stable and shows little evidence of disturbance by humans or livestock. The lake is 11 acres in size and currently hydrologically functional; however, there is evidence of off-highway vehicle use around the lake shoreline that presents the potential for resource damage. A 0.2-acre compacted parking and camping area adjacent to the shore is hydrologically connected to the lake, but large woody debris and live vegetation along the shore are function as an effective sediment filter for flow to the lake. In 2013, an unauthorized lake access spur road to Lake Moran within the Inventoried Roadless Area was blocked was blocked with barriers to keep vehicles from the shoreline and prohibit access to unauthorized off-highway vehicle routes.

Swamp Lake

Swamp Lake consists of a shallow pond and surrounding wet meadow dominated by dense herbaceous vegetation. During the grazing season, Swamp Lake is fenced, keeping hydraulic function in good working condition. A non-NFTS spur road and dispersed campsite near the northeastern edge of the meadow is hydrologically connected but delivers only small amounts of runoff and sediment to the meadow because runoff is readily filtered by the dense vegetation and low gradient. The 2012 EA and DN approved measures to restrict vehicular access to the non-NFTS road through the placement of boulders, logs, or other barriers, but these actions have not been carried out.

Big Prather Meadow

Big Prather Meadow Creek

Big Prather Meadow Creek represents a HUC 8 watershed. Like many of the drainages within the project area, Big Prather Meadow Creek is generally in good stream health. Channel form does not show signs of active downcutting or accelerated incision and shows good equilibration and stabilization. Like many riparian and aquatic features within the project area, the creek form is stabilizing following a history of instability likely caused by past management activities in the area. The stream is moderately shaded, providing enough cover to maintain cool water temperatures (between 9 and 15 degrees Celsius; USDA 2012). The geomorphology and physical characteristics of Big Prather Meadow Creek suggest that the stream habitat is of sufficient quality to support fisheries; however, no fish or other aquatic fauna were observed during the 2009 SSI survey (USDA 2012).

Slopes adjacent to the stream channel support some riparian aspen and willow obligate vegetation; however, the riparian environment is dominated by non-obligate riparian vegetation. Age classes of aspen are generally mature, and densities are sparse to light, while age classes for willow are diverse and densities sparse. Non-obligate riparian vegetation is characterized primarily stands of

mixed conifer and red fir, typical of the general forest condition class within the project area. Age classes for non-obligate riparian vegetation are diverse and densities range from light to moderate.

5.2 Wetlands

Wetland habitats, including fresh emergent wetlands and wet meadows, are limited in extent. Big Prather Meadow is the most substantial wetland feature—approximately 15 acres in size—within the project area (Figure 4). It is in the Big Prather Meadow HUC 8 watershed. Most of the meadow is located on a private inholding within the project site and is therefore not accessible for direct observation. However, hydrologic function of the meadow appears to be good based on water quality and stream condition data collected upstream and downstream of the meadow (USDA 2012). The Big Prather Meadow HUC 8 watershed is also the location of Seagles and Little Prather Meadows. Seagles Meadow is located alongside NFTS road 6N17 where road drainage has caused gullying and incision into the meadow. Easy motor vehicle access from this road has also created substantial damage. Seagles Meadow is also under threat from downstream channel incision that could migrate upstream, which would lower the water table and drain the meadow. Little Prather Meadow is adjacent to and outside of the project area.

Three fen/spring complexes within the Whittles Upper Camp watershed in the south-central portion of the watershed were evaluated by an interdisciplinary team in November 2010 using the Proper Functioning Conditions survey protocol for lentic areas and fens (USDI 2003; Weixelman and Cooper 2009). Conditions at all three features were evaluated and determined to be "functional-at-risk," due primarily to hydrologic alteration from extensive picking and trailing generated by livestock grazing. In 2016, exclusion fencing was implemented around these features to protect them from livestock grazing. A fourth spring/wet meadow aquatic feature near FSTS road 5N14H, exhibiting extensive cattle pocking, was identified during the November 2009 survey. During the survey, this wetland was noted to have the early stages of channel formation and groundwater loss because of pocking from cattle grazing.

5.3 Soils

Soils within the project area are characterized by two dominant soil types; Gerle series soil types and Windy series soil types. The majority of riparian and aquatic features in the project area are located on these soils. These soils are generally coarse, well-drained soil types. Under undisturbed conditions and where effective ground cover is present, these soils present low erosion hazard as a result of these characteristics. There are hydric soils present locally within the project area, but these have not been mapped as a part of the major soil units. Hydric soils are confined to areas within and near wet meadows, seeps and springs, and fens, Soil types and their characteristics within the project area are presented in Table 3.

Table 3 Soil Types Within the Project Area

Soil Name	Soil Description
Major Series/Family Soil Components	
Gerle Series	Gerle soils are a dominant soil of the project area, comprising 55.5 percent of the project area. These soils are formed in granitic glacial till and glacial outwash alluvium, and therefore occur on ground moraine and outwash plains of mountain areas. Slopes in the project area hosting these soils range from 5

Soil Name	Soil Description
	to 50 percent. Soil texture ranges from bouldery sandy loam to gravelly sandy loam and are generally very deep, developed soils but do exhibit rock outcroppings locally. Erosion hazard ranges from low to moderate, and the more deeply developed Gerle soil units within the project area have a high probability of displacement. Within the project area, this soil series belongs to soil hydrologic group A; therefore, these soils are well-drained and have high infiltration rates. This soil type is not classified as a hydric soil type.
Windy Series	Windy soils are a dominant soil of the project area, comprising 34.5 percent of the project area. These soils have formed in weathered material of andesitic volcanic mud flows and occur on mountains and mountain plateaus. Within the project area, these soils have a low to moderate soil erosion hazard rating, and soil texture ranges from gravelly sandy loam to gravelly coarse sandy loam. They occur over a wide range of slopes within the project area but occur with greater frequency on low to moderate slopes (5 to 35 percent). These soils have a high probability of displacement within the project area, and like the Gerle series soils belong to hydrologic group A; therefore, these soils are well-drained and have high infiltration rates. This soil type is not classified as a hydric soil type.
Lithic Cryumbrepts Family	The Lithic Cryumbrepts soil family covers approximately 6 percent of the project area. It represents a shallow (less than 10 inches), loamy soil; with moderate erosion hazard and high probability of displacement. It belongs to hydrologic soil group D; therefore, this soil type has a high runoff potential. This is primarily due to sediment size versus infiltration characteristics, which is generally high. This soil type is not classified as a hydric soil type.
Minor Series Components	
Entic Cryumbrepts Family	Only 0.2 percent of the project area is covered by Entic Cryumbrepts-type soils. These soils are of finer texture than the dominant soil types of the project area and occur on lower slopes near riparian areas. As such, they are also wetter for longer periods of the year than the more dominant, upland soil types. These soils are also susceptible to compaction, and therefore require additional management considerations when working in these areas. This soil type is not classified as a hydric soil type.
Rock Outcrop	Rock outcrop in the project area is intermixed with corresponding soil types and includes weathered bedrock of the Mehrten formation, a unit composed of pyroclastic volcanics and mudflows; quartz diorite and other felsic igneous rocks; and minor amounts of diorite and gabbro. This soil type is not classified as a hydric soil type.
Lava Caps	Volcanic rock outcrop along the mountain peaks, found on slopes of 30 to 70 percent. Depth to bedrock is very shallow, 0 to 4 inches, with little to no soil development. This soil type is not classified as a hydric soil type.

Source: NRCS 1998, 2006, and 2019.

Project Area Road Network

The watersheds within the project area contain a substantial number of roads (Appendix A; Figure 3), with road densities ranging from approximately 2.2 to 5.7 roads miles of road per square mile of project area. Most roads are NFTS-designated roads. A road inventory was carried out throughout most of the project area in 2009 to establish the extent of hydrologically connected segments (HCS) of unpaved Forest Service roads that have the potential to deliver sediment via a direct connection

to receiving waters during periods of runoff. Numerous HCS of unpaved NFTS roads within the project area were identified, many of which were proposed for maintenance, reconstruction, or decommissioning and closure in the 2012 EA and DN; however, these roads have not undergone treatment since the decision.

6 RIPARIAN CONSERVATION AREAS

RCAs are defined and described in detail in the 2017 STF *Forest Plan Direction* (USDA 2017). Within the Prather-Medusa project area, the RCA designation applies within 300 feet on each side of all perennial streams and Special Aquatic Features (SAFs; e.g., lakes, wet meadows, bogs, fens, wetlands, vernal pools, and springs), and within 150 feet on each side of all intermittent and ephemeral streams measured from the bank full edge of the stream (Appendix A; Figure 4). RCAs are designed to achieve and maintain desired conditions, which include meeting water quality goals, maintaining habitat that supports viable plant and wildlife populations, and maintaining habitat connectivity and ecological function (USDA 2017). The 2017 STF *Forest Plan Direction* outlines Standards and Guidelines for RCAs as well as RCOs that are considered when designing RCAs (USDA 2017).

To help achieve the RCOs, STF has developed RCA Operating and Equipment Specifications, which are included in detail in Table 1 of Appendix B. Specifically, only hand treatments would be allowed within 0–15 feet of an RCA feature (i.e., perennial, intermittent, and ephemeral streams; SAFs), skidding (e.g., rubber-tired skidders, track-laying tractors) would be prohibited within 0–50 feet of an RCA feature, and mechanical harvest would be severely limited within RCAs to prevent soil erosion, vegetation loss, and water quality impacts.

6.1 Management Requirements within RCAs

Activities implemented within RCAs must adhere to strict management requirements that have been designed to protect water quality, watershed condition, and aquatic habitat. Management requirements for the Proposed Action are based on the activities proposed and are derived from the requirements identified in the Region 5 Soil and Water Conservation Handbook (FSH 2509.22) and Riparian Conservation Objectives Standards and Guidelines confirmed in the SNFPA ROD (USDA 2004). RCAs are therefore protected through the application of these management requirements. Management requirements relating to the protection of hydrological resources for the Proposed Action are presented in Appendix B.

During project implementation, the project manager or administrator would be responsible for ensuring that management requirements for the Proposed Action are adhered to. A Forest Service hydrologist, or their designee, would be consulted before initiating any of the proposed treatment activities, and would monitor activities to ensure that management requirements are being followed and that they effective during project implementation.

Mechanized Equipment Operations

STF identifies three zones within RCAs based on their ability to support various levels of mechanized equipment operation. These zones are adapted based on guidance in *Mechanized Equipment Operations in Riparian Conservation Areas* (Frazier 2006). Each zone is situated at

various distances from the edge of the aquatic feature, providing concentric buffers of protection. Nearest to the stream is an exclusion zone, providing the highest level of protection; followed by a transition zone; and an outer zone, with restrictions easing with distance from the river, stream, or other aquatic feature. The size of the exclusion, transition, and outer zones are based on the type of aquatic feature and type of equipment or activity in question. Perennial and intermittent streams and SAFs follow the same restrictions for mechanical equipment operation, and ephemeral streams follow another set of restrictions. Mechanical equipment operation restrictions are illustrated in Figure 5 of Appendix A, summarized in Table 1 of Appendix B, and described in detail below.

Exclusion Zone

Depending on the geomorphology of the feature, the exclusion zone for perennial and intermittent streams starts at either the edge of the active channel where slopes rise uniformly from the stream, or at the outer edge of the following features, whichever is furthest from the stream: the first slope-break adjacent to the stream (e.g., streambank, inner gorge), flat or nearly flat ground adjacent to the channel (e.g., floodplain or terrace), or where obligate riparian shrub and/or tree communities begin. The exclusion zone for ephemeral streams begins at the edge of the active channel where slopes rise uniformly away from the stream, or at the edge of the streambank, whichever is furthest.

For SAFs, the exclusion zone starts at the outer edge of obligate trees, shrubs or herbaceous plants in wet meadows and springs or the high-water line of lakes and vernal pools; or the top of the first slope-break immediately adjacent to the SAF if it is further than the obligate vegetation or high-water line.

Skidding equipment (e.g., rubber-tired skidders and track-laying tractors) is not allowed within 50 feet of the start of the exclusion zone for perennial and intermittent streams and SAFs (Appendix A; Figure 5), and is not allowed within 25 feet of ephemeral streams; mechanical harvesting and shredding equipment (e.g. feller-bunchers and masticators) is not allowed within 15 feet of the start of the exclusion zone for any riparian feature (Appendix A; Figure 5). No damage to streambanks from mechanical equipment is allowed within exclusion zones. Debris created from operations would be removed from stream channels, and all stability-maintaining and obligate vegetation would be retained in these areas.

Transition Zone

The transition zone differs in width for skidding equipment and mechanical harvesting equipment, and for perennial and intermittent streams and SAFs, and ephemeral streams. For the use of skidding equipment in perennial and intermittent streams and SAF RCAs, it is 50 feet wide, and begins at the end of the exclusion zone, which is 50 feet from the edge of the riparian feature; therefore it measures from 50 to 100 feet of the edge of the riparian feature (Appendix A; Figure 5). The transition zone for mechanized harvesting and shredding equipment in perennial and intermittent streams and SAF RCAs is 85 feet wide and starts at the end of the exclusion zone, which is 15 feet from the edge of the riparian feature; therefore, it measures from 15 to 100 feet from the edge of the riparian feature (Appendix A; Figure 5). For ephemeral streams, the transition zone for skidding equipment is from 25 to 50 feet of the riparian feature, and for mechanical harvesting equipment it is from 15 to 50 feet of riparian features.

Equipment is permitted to operate within the transition zones with limitations to protect the integrity and function of the RCA. For example, the use of existing skid trails would be prioritized based on environmental impact, new skid trails would not be allowed within 100 feet of any stream,

and where skidding equipment is operating, a minimum of 50 percent evenly distributed ground cover would have to be retained in tracked areas. For mechanical harvesting equipment, minimum ground cover would also have to be retained in tracked areas according to the specifications identified in Table 1 of Appendix B.

Outer Zone

The outer zone acts as a gradient from limited equipment operation to normal operation. Skidding equipment and mechanical harvesting equipment may operate throughout the outer zone, with the density and intensity of skid trails and tracked area gradually increasing from the transition zone to the outer limit of the RCA. There is no outer zone for ephemeral streams.

6.2 RCO Analysis

As stated above, the SNFPA FEIS ROD requires that a site-specific project-level analysis be conducted to determine whether the activities associated with a proposed project within an RCA are sufficiently protective and meet the RCOs identified as a part of the SNFPA AMS. The RCO analysis is provided below and considers applicable management requirements as features of the Proposed Action.

Activities Proposed within RCAs

Per Standard and Guideline #94 of the SNFPA (USDA 2004), "As part of project-level analysis, conduct peer reviews for projects that propose ground-disturbing activities in more than 25 percent of the RCA or more than 15 percent of a CAR." The project would not exceed these thresholds for RCAs within the project area.

Implementing the project would result in "ground disturbing activities," which are defined in the ROD as "activities that result in detrimental soil compaction or loss of organic matter beyond the thresholds identified in the soil quality standards." The soil quality standards (USDA 2001: Appendix F) identify the following applicable soil standards, beyond which effects are considered detrimental:

- For soil compaction, a ten percent or greater reduction in total soil porosity.
- For soil strength, an increase in soil strength greater than 500 kPa between disturbed and undisturbed sites.
- For organic matter:
  - maintain the upper 12 inches of soil so that it is at least 85 percent of the total soil organic matter found under natural conditions for the same or similar soils;
  - ensure that fine surface organic matter occurs over at least 50 percent of the area and is well distributed; and
  - maintain at least 5 well-distributed logs per acre representing the range of decomposition classes.

There are no CARs in the project area, but creation of new roads, necessary improvements to existing roads for project implementation, the use of mechanical thinning equipment and skidders, and prescribed fire would involve vegetation clearing, grading, and soil disturbance, which would be located within RCAs per the specifications identified in Table 1 of Appendix B. These ground

disturbing activities would be implemented over multiple seasons, and in multiple treatment areas throughout the project area. It is therefore unlikely that any single treatment project carried out under the Proposed Action would result in disturbance of more than 25 percent of an RCA at any one time. Nevertheless, management requirements specify upper limits on the amount of ground disturbance from any of the project activities within the exclusion, transition, and outer zones of an RCA such that the disturbance area during project implementation would remain below these thresholds. Management requirements also provide limits on timing and extent of activities based on soil conditions that would protect sensitive soils. Moreover, even with implementation of activities within RCA transition and outer zones, operation of equipment may not always result in detrimental soil effects beyond the limits specified above.

Riparian Conservation Objective #1

Table 4 Riparian Conservation Objective #1

RCO	Links to AMS Goals
Ensure that identified beneficial uses for the waterbody are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.	#1 Water Quality
	#2 Species Viability
	#7 Watershed Condition

The project lies within the Middle North Fork Stanislaus River Hydrologic Area (Hydrologic Unit number 534.; Central Valley Water Quality Control Board 2019, HUC 180400100303; USGS 2019). Named drainage features near the project area include Big Rattlesnake Creek, Little Rattlesnake Creek, and their tributaries, Swamp Lake, and Lake Moran. One seasonal drainage to the Middle North Fork Stanislaus River overlaps with the project area in the southwestern portion of the project area, but the feature itself is not located within the project boundary. The Middle North Fork Stanislaus River RCA does not overlap with the footprint of disturbance associated with the Proposed Action; however, all drainages within the project area are tributary to the Middle North Fork Stanislaus River. Beneficial uses for surface waters, as identified by Central Valley RWQCB in the Basin Plan are listed in Table 2, above.

Consistent with the federal Clean Water Act, the Forest Service implements BMPs approved by the California State Water Resources Control Board as its primary approach to protecting water quality from the various nonpoint source activities which it conducts or administers. Those nonpoint source activities include the following: a) timber management, b) road and road system construction and maintenance, mining, recreation (including marinas and pack-stock), fire suppression and fuels management, and watershed management. The expertise, resources, and authorities of Forest Service can be an invaluable asset to the water boards in maintaining water quality where it is in good condition, protecting it where may be threatened and contributing to its restoration where it is impaired.

Implementation of the Proposed Action would require a written contract between the contractor performing fuel and road treatment activities, and the Forest Service. The contract would include the management requirements described above that include erosion and sediment control BMPs that follow the guidelines in the Region 5 Soil and Water Conservation Handbook (FSH 2509.22; USDA 2011) and the Forest Service Handbook. The management requirements identified in

Appendix B would be adhered to during project activities and could be modified at the discretion of Forest Service specialists during project implementation, based on observed effectiveness during project implementation.

Standards and Guidelines

Table 5 Standards and Guidelines associated with Riparian Conservation Objective 1

Number	Standard and Guideline	Analysis
95	For waters designated as "water quality limited" (CWA Section 303(d)), participate in the development of Total Maximum Daily Loads (TMDLs) and TMDL Implementation Plans. Execute applicable elements of completed TMDL Implementation Plans	Not applicable. There are no Section 303(d)-listed waterbodies within the watersheds that overlap with the Prather-Medusa project area.
96	Ensure that management activities do not adversely affect water temperatures necessary for local aquatic- and riparian-dependent species assemblages.	Reductions in tree canopy cover percentages from forest thinning activities could result in minor increases in stream water temperatures. However, any increases would not be expected to adversely affect the beneficial uses identified for the waterbodies within the project area (Table 2). A minimum 60 percent canopy cover would be maintained in all perennial RCAs. For small forested streams, research has shown that elevated water temperatures resulting from a reduction in shade decrease to normal levels within 500 feet downstream of the affected reach.
97	Limit pesticide application to cases where project-level analysis indicates that pesticide application are consistent with riparian conservation objectives.	Application of Sporax is proposed to treat heterobasidion root disease in fir trees. A borate compound registered by the U.S. Environmental Protection Agency in the State of California (e.g., Sporax®) would be applied on cut tree stumps greater than 14 inches dbh in identified root rot pockets. Application rates of the borate compound would be 1.0 pounds per acre within known infection zones. The borate compound would not be applied within 50 feet of established recreation site, permittee improvements, or frequented livestock watering sites, or within 10 feet of any surface water, per the specifications in management requirement SW-24 Management requirements that prohibit the application of Sporax within 10 feet of surface water and during precipitation events or forecasted precipitation will minimize the risk of Sporax entering waterbodies.

Number	Standard and Guideline	Analysis
98	Avoid pesticide applications within 500 feet of known occupied sites for the California red- legged frog, Cascade frog, Yosemite toad, foothill yellow-legged frog, mountain yellow-legged frog, and northern leopard frog unless environmental analysis documents that pesticides are needed to restore or enhance habitat for these amphibian species.	There are no known populations of California red-legged frog, Cascade frog, Yosemite toad, foothill yellow-legged frog, mountain yellow-legged frog, or northern leopard frog.
99	Prohibit storage of fuels and other toxic materials within RCAs except at designated administrative sites and sites covered by a Special Use Authorization. Prohibit refueling within RCAs unless there are no other alternatives. Ensure that spill plans are reviewed and up-to-date.	Fuel and other toxic material will not be stored in RCAs. Fueling and servicing of equipment is only allowed at approved sites and is prohibited within RCAs. A current Spill Prevention and Containment Countermeasure (SPCC) Plan will be required when fuel storage exceeds thresholds (see Management Requirements).

Riparian Conservation Objective #2

Table 6 Riparian Conservation Objective #2

RCO	Links to AMS Goals
Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; (2) streams, including in stream flows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species.	#2 Species Viability
	#3 Plant and Animal Community Diversity
	#4 Species Habitats
	#5 Watershed Connectivity
	#6 Floodplains and Water Tables
	#8 Streamflow Patterns and Sediment Regimes
	#9 Streambanks and Shorelines

Table 7 Standards and Guidelines associated with Riparian Conservation Objective 2

Number	Standard and Guideline	Analysis
100	Maintain and restore the hydrologic connectivity of streams, meadows, wetlands, and other special aquatic features by identifying roads and trails that intercept, divert, or disrupt natural surface and subsurface water flow paths. Implement corrective actions where necessary to restore connectivity.	Road-generated runoff and sediment would be reduced through a combination of maintenance and reconstruction. See Appendix B for Management Requirements applicable to road activities.
101	Ensure that culverts or other stream crossings do not create barriers to upstream or downstream passage for aquatic-	Water drafting will be conducted according to Management Requirements that will ensure adequate stream flows for

Number	Standard and Guideline	Analysis
	dependent species. Locate water-drafting sites to avoid adverse effects to in- stream flows and depletion of pool habitat. Where possible, maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows, wetlands, and other special aquatic features.	aquatic habitat. See Appendix B for Management Requirements applicable to water drafting. Removal of conifers is proposed in meadows with conifer encroachment of aspen stands; this could increase the water table elevation and seasonal duration of wetness in some meadows as transpiration decreases due to conifer removal.
102	Before activities that could adversely affect streams, determine if relevant stream characteristics are within the range of natural variability. If characteristics are outside the range of natural variability, implement mitigation measures and short-term restoration actions needed to prevent further declines or cause an upward trend in conditions. Evaluate required long-term restoration actions and implement them according to their status among other restoration needs	In 2009, Stanislaus Streamscape Inventory (SSI) surveys were conducted on the three major streams in the project area (Big Rattlesnake, Little Rattlesnake, and Big Prather Creeks). Big and Little Rattlesnake Creeks both showed evidence of past and ongoing channel instability during the survey, likely resulting from past management activities (e.g., timber harvest, roads, grazing). Big Rattlesnake Creek was also identified as having a lack of obligate riparian vegetation. While many of the unstable stream reaches are in the process of recovering naturally, some restoration activities were proposed and approved in the 2012 EA and DN in connection with fuel harvest activities including planting woody obligate riparian vegetation along Big Rattlesnake Creek and restoration of an incised tributary to Little Rattlesnake Creek. Those activities would still be carried out in connection with fuel treatments proposed under this project. Additional active channel restoration is not proposed under the Proposed Action. Management Requirements incorporating standard BMPs would be followed to reduce the risk of disturbance within RCAs and protect streambanks (see Table 1, *Mechanized Equipment Operations within RCAs*, in Appendix B).
103	Prevent disturbance to meadow-associated streambanks and natural lake and pond shorelines caused by resource activities from exceeding 20 percent of stream reach or 20 percent of natural lake and pond shorelines	Management Requirements prohibit or limit mechanized equipment operation within RCAs (see Table 1, *Mechanized Equipment Operations within RCAs*, in Appendix B). Damage to streambanks would be avoided with implementation of the Proposed Action.

Number	Standard and Guideline	Analysis
104	In stream reaches occupied by or identified as "essential habitat" in the conservation assessment for, the Lahontan and Paiute cutthroat trout and the Little Kern golden trout, limit streambank disturbance from livestock to 10 percent of the occupied or "essential habitat" stream reach. (Conservation assessments are described in the record of decision.) Cooperate with State and Federal agencies to develop streambank disturbance standards for threatened, endangered, and sensitive species. Use the regional streambank assessment protocol. Implement corrective action where disturbance limits have been exceeded.	Not applicable. There are no threatened, endangered, or sensitive trout species within the watershed where the project area is located.
105	At either the landscape or project-scale, determine if the age class, structural diversity, composition, and cover of riparian vegetation are within the range of natural variability for the vegetative community. If conditions are outside the range of natural variability, consider implementing mitigation and/or restoration actions that will result in an upward trend. Actions could include restoration of aspen or other riparian vegetation where conifer encroachment is identified as a problem.	Conifer encroachment is a problem at several meadows with aspen stands within the project area, which has caused a decline in aspen and other meadow vegetation. Conifer removal at aspen-meadow complexes is proposed under the Proposed Action and is expected to increase the reproduction and vigor of aspen stands and meadow vegetation.
106	Cooperate with Federal, Tribal, State and local governments to secure in stream flows needed to maintain, recover, and restore riparian resources, channel conditions, and aquatic habitat. Maintain in stream flows to protect aquatic systems to which species are uniquely adapted. Minimize the effects of stream diversions or other flow modifications from hydroelectric projects on threatened, endangered, and sensitive species.	Not applicable. The Proposed Action does not involve any activities that would have any appreciable effect on stream flows.
107	For exempt hydroelectric facilities on national forest lands, ensure that special use permit language provides adequate in stream flow requirements to maintain, restore, or recover favorable ecological conditions for local riparian- and aquatic-dependent species.	Not applicable. The Proposed Action does not involve activities that would affect hydroelectric facilities or operations.

Riparian Conservation Objective #3

Table 8 Riparian Conservation Objective #3

RCO	Links to AMS Goals
Ensure a renewable supply of large down logs that: (1) can reach the stream channel and (2) provide suitable habitat within and adjacent to the RCA.	#2 Species Viability
	#3 Plant and Animal Community Diversity

Table 9 Standards and Guidelines associated with Riparian Conservation Objective 3

Number	Standard and Guideline	Analysis
108	Determine if the level of coarse large woody debris (CWD) is within the range of natural variability in terms of frequency and distribution and is sufficient to sustain stream channel physical complexity and stability. Ensure proposed management activities move conditions toward the range of natural variability.	SSI surveys carried out in 2009 showed in-channel CWD accumulations to be generally well distributed and averaging between 15 and 19 pieces per 100 meters of channel length. CWD accumulations noted in Big Rattlesnake, Little Rattlesnake, and Big Prather Creeks are within the range of natural variability and appear to be sufficient for maintaining stream channel physical complexity and stability. Management Requirements would ensure that project activities do not adversely affect recruitment of CWD. A minimum of 60% canopy cover would be maintained in all perennial RCAs, ensuring that an adequate supply of trees is maintained and available for future recruitment to stream channels.

Riparian Conservation Objective #4

Table 10 Riparian Conservation Objective #4

RCO	Links to AMS Goals
Ensure that management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.	#2 Species Viability
	#7 Watershed Condition

Table 11 Standards and Guidelines associated with Riparian Conservation Objective 4

Number	Standard and Guideline	Analysis
109	Within CARs, in occupied habitat or "essential habitat" as identified in conservation assessments for threatened, endangered, or sensitive species, evaluate the	Not applicable. There are no CARs within the project area.

Number	Standard and Guideline	Analysis
	appropriate role, timing, and extent of prescribed fire. Avoid direct lighting within riparian vegetation; prescribed fires may back into riparian vegetation areas. Develop mitigation measures to avoid impacts to these species whenever ground-disturbing equipment is used.	
110	Use screening devices for water drafting pumps. (Fire suppression activities are exempt during initial attack.) Use pumps with low entry velocity to minimize removal of aquatic species, including juvenile fish, amphibian egg masses and tadpoles, from aquatic habitats.	Water drafting will be conducted in compliance with the Management Requirements identified in Appendix B.
111	Design prescribed fire treatments to minimize disturbance of ground cover and riparian vegetation in RCAs. In burn plans for project areas that include, or are adjacent to RCAs, identify mitigation measures to minimize the spread of fire into riparian vegetation. In determining which mitigation measures to adopt, weigh the potential harm of mitigation measures, for example fire lines, against the risks and benefits of prescribed fire entering riparian vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could be damaging to habitat or long-term function of the riparian community.	Prescribed fire is a component of the Proposed Action and will be conducted in compliance with the Management Requirements identified in Appendix B.
112	Post-wildfire management activities in RCAs and CARs should emphasize enhancing native vegetation cover, stabilizing channels by non-structural means, minimizing adverse effects from the existing road network, and carrying out activities identified in landscape analyses. Post-wildfire operations shall minimize the exposure of bare soil.	Not applicable. The Proposed Action does not propose post-wildfire management activities.
113	Allow hazard tree removal within RCAs or CARs. Allow mechanical ground disturbing fuels treatments, salvage harvest, or commercial fuelwood cutting within RCAs or CARs when the activity is consistent with RCOs. Utilize low ground pressure equipment, helicopters, over the snow logging, or other non-ground disturbing actions to operate off of existing roads when	Management Requirements prohibit or limit mechanized equipment operation within RCAs (see Table 1, *Mechanized Equipment Operations within RCAs*, in Appendix B). Damage to streambanks would be avoided with implementation of the Proposed Action. In addition, riparian vegetation must be retained, and any

Number	Standard and Guideline	Analysis
	needed to achieve RCOs. Ensure that existing roads, landings, and skid trails meet Best Management Practices. Minimize the construction of new skid trails or roads for access into RCAs for fuel treatments, salvage harvest, commercial fuelwood cutting, or hazard tree removal.	operation-created debris must be removed from the stream channel. Management Requirements also require that new landings not be constructed within 100 feet of perennial or intermittent streams or within 50 feet of ephemeral streams and that log landings be subsoiled when biomass operations are complete. Existing skid trails would be used wherever possible except where unacceptable resource damage may result. Skid trails would be located at least 100 feet from any perennial or intermittent stream or SAF and at least 50 feet from any ephemeral stream.
114	As appropriate, assess and document aquatic conditions following the Regional Stream Condition Inventory protocol before implementing ground disturbing activities within suitable habitat for the California red-legged frog, Cascade frog, Yosemite toad, foothill and mountain yellow-legged frogs, and northern leopard frog.	Suitable habitat for these aquatic species may exist in the project area, although no individuals have been documented. Additionally, the project area is outside of the range for the Cascade frog and California red-legged frog. Stream Condition Inventory (SCI) surveys have not been conducted within the project area. However, SSI surveys were carried out in 2009 on the three major streams in the project area (Big Rattlesnake, Little Rattlesnake, and Big Prather Creeks). SSI is a rapid, extensive survey that includes adaptations of many of the same survey parameters as SCI and can give a general picture of aquatic conditions over a larger area. SSI results indicate aquatic conditions in streams surveyed are generally in good condition.
115	During fire suppression activities, consider impacts to aquatic- and riparian-dependent resources. Where possible, locate incident bases, camps, helibases, staging areas, helispots, and other centers for incident activities outside of RCAs or CARs. During pre-suppression planning, determine guidelines for suppression activities, including avoidance of potential adverse effects to aquatic- and riparian-dependent species as a goal.	Not applicable. The Proposed Action does not involve fire suppression activities or pre-suppression planning.
116	Identify roads, trails, OHV trails and staging areas, developed recreation sites, dispersed campgrounds, special use permits, grazing permits, and day use sites during landscape	Road-generated runoff and sediment would be reduced through a combination of maintenance and reconstruction of existing roads. Standard BMPs

Number	Standard and Guideline	Analysis
	analysis. Identify conditions that degrade water quality or habitat for aquatic and riparian-dependent species. At the project level, evaluate and consider actions to ensure consistency with standards and guidelines or desired conditions.	incorporated into Management Requirements for the project area would be implemented during maintenance and construction activities to avoid or reduce impacts to water quality and habitat for aquatic and riparian-dependent species. See Appendix B for Management Requirements applicable to road activities.

Riparian Conservation Objective #5

Table 12 Riparian Conservation Objective #5

RCO	Links to AMS Goals
Preserve, restore, or enhance special aquatic features, such as meadows, lakes, ponds, bogs, fens, and wetlands, to provide the ecological conditions and processes needed to recover or enhance the viability of species that rely on these areas	#1 Water Quality
	#2 Species Viability
	#3 Plant and Animal Community Diversity
	#4 Species Habitats
	#7 Watershed Condition
	#9 Streambanks and Shorelines

Table 13 Standards and Guidelines associated with Riparian Conservation Objective 4

Number	Standard and Guideline	Analysis
117	Assess the hydrologic function of meadow habitats and other special aquatic features during range management analysis. Ensure that characteristics of special features are, at a minimum, at Proper Functioning Condition, as defined in the appropriate Technical Reports (or their successor publications): (1) "Process for Assessing PFC" TR 1737-9 (1993), "PFC for Lotic Areas" USDI TR 1737-15 (1998) or (2) "PFC for Lentic Riparian-Wetland Areas" USDI TR 1737-11 (1994).	Not applicable. Range management is not proposed as a part of the Proposed Action.
118	Prohibit or mitigate ground-disturbing activities that adversely affect hydrologic processes that maintain water flow, water quality, or water temperature critical to sustaining bog and fen ecosystems and plant species that depend on these ecosystems. During project analysis, survey, map, and develop measures to protect bogs and fens from such activities as trampling by livestock, pack stock, humans, and wheeled vehicles. Criteria for defining bogs and fens	Management Requirements prohibit or limit mechanized equipment operation within RCAs, including RCAs for bog and fen ecosystems (see Table 1, *Mechanized Equipment Operations within RCAs,* in Appendix B).

Number	Standard and Guideline	Analysis
	include, but not limited to, presence of: (1) sphagnum moss (*Spagnum* spp.), (2) mosses belonging to the genus Meesia, and (3) sundew (*Drosera* spp.). Complete initial plant inventories of bogs and fens within active grazing allotments before re-issuing permits.	
119	Locate new facilities for gathering livestock and pack stock outside of meadows and riparian conservation areas. During project-level planning, evaluate and consider relocating existing livestock facilities outside of meadows and riparian areas. Before re-issuing grazing permits, assess the compatibility of livestock management facilities located in riparian conservation areas with riparian conservation objectives.	Not applicable. Development of new livestock gathering facilities is not part of the Proposed Action.
120	Under season-long grazing: • For meadows in early seral status: limit livestock utilization of grass and grass-like plants to 30 percent (or minimum 6-inch stubble height). • For meadows in late seral status: limit livestock utilization of grass and grass-like plants to a maximum of 40 percent (or minimum 4-inch stubble height). Determine ecological status on all key areas monitored for grazing utilization before establishing utilization levels. Use Regional ecological scorecards and range plant list in regional range handbooks to determine ecological status. Analyze meadow ecological status every 3 to 5 years. If meadow ecological status is determined to be moving in a downward trend, modify or suspend grazing. Include ecological status data in a spatially explicit Geographical Information System database. Under intensive grazing systems (such as rest-rotation and deferred rotation) where meadows are receiving a period of rest, utilization levels can be higher than the levels described above if the meadow is maintained in late seral status and meadow-associated species are not being impacted. Degraded meadows (such as those in early seral status with greater than 10 percent of	Not applicable. Establishment of livestock utilization is not part of the Proposed Action.

Number	Standard and Guideline	Analysis
	the meadow area in bare soil and active erosion) require total rest from grazing until they have recovered and have moved to mid- or late seral status.	
121	Limit browsing to no more than 20 percent of the annual leader growth of mature riparian shrubs and no more than 20 percent of individual seedlings. Remove livestock from any area of an allotment when browsing indicates a change in livestock preference from grazing herbaceous vegetation to browsing woody riparian vegetation.	Not applicable. Cattle browse standards and limits are not proposed as a part of the Proposed Action.

Riparian Conservation Objective #6

Table 14 Riparian Conservation Objective #6

RCO	Links to AMS Goals
Identify and implement restoration actions to maintain, restore or enhance water quality and maintain, restore, or enhance habitat for riparian and aquatic species	#1 Water Quality
	#2 Species Viability
	#3 Plant and Animal Community Diversity
	#4 Species Habitats
	#5 Watershed Connectivity
	#6 Floodplains and Water Tables
	#7 Watershed Condition
	#8 Streamflow Patterns and Sediment Regimes
	#9 Streambanks and Shorelines

Table 15 Standards and Guidelines associated with Riparian Conservation Objective 6

Number	Standard and Guideline	Analysis
122	Recommend restoration practices in: (1) areas with compaction in excess of soil quality standards, (2) areas with lowered water tables, or (3) area that are either actively down cutting or that have historic gullies. Identify other management practices, for example, road building, recreational use, grazing, and timber harvests, that may be contributing to the observed degradation.	Road maintenance activities associated with the Proposed Action would improve surface runoff quality in the mid-to-long-term. Management requirements for road maintenance and construction would protect water quality in the short term. See Appendix B for Management Requirements applicable to road activities. Conifer removal is proposed for aspen stands. Removal of encroaching conifers would allow recovery of the water table at stand and meadow peripheries and increase seasonal wetness in areas where conifers currently draw excess water from these systems.

Standards and Guidelines not Associated with an RCO

Four of the standards and guidelines identified in the SNFPA ROD (USDA 2004) are not associated with any specific RCO but are integral to conducting an analysis of activities proposed within an RCA. They are chiefly intended to articulate the methodology that should be employed when conducting an RCO review:

- 91. Designate riparian conservation area (RCA) widths as described in Part B of this appendix. The RCA widths displayed in Part B may be adjusted at the project level if a landscape analysis has been completed and a site-specific RCO analysis demonstrates a need for different widths.
- 92. Evaluate new proposed management activities within CARs and RCAs during environmental analysis to determine consistency with the riparian conservation objectives at the project level and the AMS goals for the landscape. Ensure that appropriate mitigation measures are enacted to (1) minimize the risk of activity-related sediment entering aquatic systems and (2) minimize impacts to habitat for aquatic- or riparian-dependent plant and animal species.
- 93. Identify existing uses and activities in CARs and RCAs during landscape analysis. At the time of permit reissuance, evaluate and consider actions needed for consistency with RCOs.
- 94. As part of project-level analysis, conduct peer reviews for projects that propose ground-disturbing activities in more than 25 percent of the RCA or more than 15 percent of a CAR.

7 ENVIRONMENTAL CONSEQUENCES

7.1 Direct and Indirect Effects

Mechanized Equipment

Activities related to the Proposed Action for the treatment of forest fuels and commercial timber harvest such as mechanical harvesting, log skidding, mastication, and biomass removal could cause localized erosion and sedimentation of waterways on a short-term basis. The types of mechanized equipment that would be involved under the Proposed Action to treat and thin forest vegetation include masticators, bull dozers, track-mounted mechanical harvesters, feller-bunchers, rubber-tired skidders, and fixed-track grapple skidders. Such equipment has a high potential to disturb forest ground cover and expose bare soil, generating conditions that are conducive to high rates of erosion during and shortly following treatments.

Erosion of soil and sediment within parts of the project area undergoing treatment, and in nearby or adjacent areas, is a likely short-term outcome of implementation of the project. Erosion of soil and sediment ultimately leads to effects on downstream receiving waters as eroded material is transported by surface runoff and makes its way into receiving waterbodies. Sedimentation of waterbodies may threaten ecosystem health by producing effects on natural functions such as light penetration, temperature adjustment, bottom conditions, and retention of organic matter (NRCS 2017). Imbalances in these functions can lead to a degradation of hydrological conditions, producing detrimental effects on aquatic species such as increased mortality or chronic toxicity. The potential magnitude of effects is dependent on a number of factors, including the susceptibility of soils to detachment, the thickness of soil cover, the level of activity or disturbance, the

connectivity of roads, the steepness of slope, local meteorological conditions, and the sensitivity of the receiving waterbody.

A comprehensive set of management requirements based on Forest Service BMPs to protect soil and water conditions would be applied during project implementation, as discussed under "Management Requirements in RCAs," above. These management requirements have been developed and designed for the project area with the above site-specific conditions relating to the susceptibility of soils to detachment, the thickness of soil cover, the level of activity or disturbance, the connectivity of roads, the steepness of slope, local meteorological conditions, and the sensitivity of the receiving waterbody. Application of these management requirements will ensure that potential adverse effects to water and soil quality and quantity would be avoided or minimized and would only occur over a short period of time during project implementation and shortly thereafter. The management requirements include measures for the retention of soil cover, erosion control, minimizing disturbance, and restrictions on activities with a high potential for resource damage within RCAs. Specifically, project management requirements stipulate that activities within RCAs would be limited based on the sensitivity of the aquatic resource and the potential for damage. Exclusion zones have been established for RCAs as described above (see Table 1 in Appendix B). As such, mechanical equipment would not be permitted within 15 feet of any aquatic features, and skidding would be prohibited within 25 feet of ephemeral streams, and within 50 feet of all other aquatic features. Transition zones in RCAs would protect resources by imposing limitations on the use of mechanical equipment and skidders and strictly regulating the condition of soil, streams, and vegetation in areas where they are being used. For example, all riparian obligate vegetation would be retained in transition zones and would not be subject to forest thinning activities, a minimum amount of ground cover would be maintained, and excess new disturbance would be limited, as described in Table 1 of Appendix B. Finally, an outer zone that gradually transitions to normal operating conditions at the RCA boundary would be implemented. In areas outside of RCAs, limitations have been developed and would be implemented based on specific slope and soil conditions. Piling and log skidding would be prohibited on slopes over 25 and 35 percent, respectively; and a minimum soil ground cover of 50 percent would be retained in all work areas, with higher ground cover required in more sensitive areas (e.g., on lava caps, thin soils, steep slopes, or a combination of such conditions). Mechanical equipment would only be operated when soils are dry, and the type of equipment to be used would be tailored to ground conditions (see Table 2 of Appendix B).

Monitoring of past forest fuel reduction and timber harvest activities within STF and other National Forests indicates that implementation of BMPs targeted at these types of forest management practices are highly effective at limiting or preventing erosion and sedimentation of hydrologic resources (USDA 2012). Consequently, it is expected that adverse effects related to the use of mechanized equipment and log skidders would be both temporally and spatially limited and would therefore be minimized below the threshold of significance. The long-term, indirect effects of the Proposed Action would be negligible, because disturbance areas would be rehabilitated, and ground cover would be restored following treatments. Treated areas of forest would return to steady-state conditions approximately two years following implementation of the project.

Road Construction and Maintenance

Road maintenance and reconstruction activities would be required along existing NFTS roads, and construction of less than one mile of temporary roads would be required to access some of the fuel

treatment units. Temporary access roads would be decommissioned and reclaimed to natural conditions after fuel treatments are completed. Activities related to the Proposed Action for road maintenance such as clearing, road grading, and travel over roadways would result in ground disturbance that could lead to short-term accelerated erosion and sedimentation effects. Road surface treatments and improvements would involve initial ground disturbance, and a short period of erosional instability following completion of maintenance or construction (approximately 1 to 2 years [USDA 2012]).

Similar to the way that BMPs would be applied to forest fuels treatments, so too would they be applied, as appropriate, to road maintenance and temporary road construction. The FSH has robust measures for road-related activities that would reduce or minimize effects on aquatic features which would be applied to the Proposed Action. Such measures include full stabilization of project sites before wet weather, and implementation of an erosion control plan that specifically details the erosion control practices being implemented and where. Disturbance would be limited to the minimum necessary to maintain or construct roads, and roads themselves would be designed and constructed with features to minimize erosion. Road design features would include energy dissipators, minimum distance between stream crossings, culvert management, spring management, and slope stabilization. During road maintenance, roads would be watered as necessary to prevent fugitive dust emissions. Excess material from road-related activities would be disposed of in stable, dry areas, or transported off site for storage and use as future borrow. Fueling and servicing of equipment would be carried out under containment and would not be allowed in RCAs.

Monitoring of past forest road maintenance and construction activities within STF and other National Forests indicates that implementation of BMPs targeted at these types of forest management practices are highly effective at limiting or preventing erosion and sedimentation of hydrologic resources (USDA 2012). Consequently, it is expected that adverse effects related to the road management would be both temporally and spatially limited and would therefore be minimized below the threshold of significance.

Prescribed Fire

Prescribed fire may be implemented throughout the 7,132 acres of the project area. Prescribed fire would include intentional low-intensity and low-severity burning of vegetation under favorable conditions to reduce the density of trees and brush, reduce ladder fuels, and increase overall canopy height. Prescribed fire would be a follow-up treatment after mechanical thinning, salvage, and biomass treatments, and would include pile burning and broadcast burning. While the intent of prescribed fire is to produce low-intensity and low-severity fire that preserves favorable vegetation and soil conditions, it is possible that these controlled fires could burn at a higher intensity that intended and reduce soil cover below intended thresholds.

BMPs intended to protect riparian areas and water quality from prescribed fire include a prohibition on ignition in RCAs, backing prescribed fire into RCAs, locating burn piles at least 50 feet from perennial and intermittent streams and at least 25 feet from ephemeral streams, and locating dozer lines at least 100 feet from perennial and intermittent streams and at least 50 feet from ephemeral streams. Monitoring of such BMPs elsewhere within STF and other National Forests has demonstrated that such BMPs are highly effective at limiting and preventing damage to obligate riparian species, soil cover, and protecting water quality (USDA 2012). Consequently, with implementation of these BMPs, it is expected that adverse effects related to prescribed fire

would be both temporally and spatially limited and would therefore be minimized below the threshold of significance.

7.2 Cumulative Effects

Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7). Cumulative Watershed Effects are defined as "[a]ll effects on beneficial uses of water that occur away from the location of actual land use which are transmitted through the fluvial system. Effects can be either beneficial or adverse and result from the synergistic or additive effects of multiple management activities within a watershed" (USDA 1988). The direct and indirect effects of the ground-disturbing activities included in the proposed action have the potential to persist during the short to medium term (i.e. two to 10 years) and combine with past, present, and reasonably foreseeable future projects within project watersheds to produce downstream effects, and potentially impact beneficial uses of water.

Forest Service Region 5 has developed a standardized methodology for evaluation of CWE (FSH 2509.22). A CWE analysis typically combines the existing level of land disturbance with the level of disturbance proposed under a project and compares it against a threshold level of concern for that watershed. For project area watersheds, the threshold of concern is between 10 and 12 percent. This type of analysis requires numerical coefficients to be assigned to the existing level of disturbance and recovery within a watershed, as well as to the type of activity being proposed in each area. Cumulative watershed effects were assessed using Forest Service methodology (USDA 1988) and the Stanislaus National Forest CWE spreadsheet that implements the Region 5 Equivalent Road Acres (ERA) model (USDA 2003).

The ERA model is intended to predict the risk of cumulative effects, not actual effects. As such, it is intended to be an initial screen for focusing field evaluation priorities when implementing the proposed action and can successfully be used to compare effects between implementing the project or not implementing the project. Complete information on the ERA model and input parameters is contained in the CWE analysis (USDA 2020).

While project treatment acres would span seven HUC 7 watersheds, treatments would be concentrated primarily in the Whittles Upper Camp and Ganns HUC 7 watersheds; treatments in other HUC 7 watersheds comprised only 0.3 percent to 2.6 percent of the total watershed (Table 4). Given the small proportion of treatment acreage and the relatively low impact of proposed project treatments (e.g., forest thinning, prescribed fire), the proposed action would have little potential to influence CWE for these watersheds in a measurable way and, therefore, they were not included in the detailed CWE-ERA analysis.

Table 16 Treatment Acres within Hydrologic Unit Code 7 Watersheds

Hydrologic Unit Code (HUC) Name	HUC Size (acres)	Project Treatment Acres in HUC	Percentage of HUC to be Treated
Whittles Upper Camp	6,571	4,145	63
Ganns	10,576	956	9
Hells Kitchen	9,533	243	2.6
Boards Crossing-Lower North Fork Stanislaus River	8,382	23	0.3
Lower Highland Creek	10,193	60	0.6
Upper Beaver Creek	7,710	133	1.7
Middle Beaver Creek	8,166	141	1.7

Source: Modified from USDA 2020

Roads comprise the majority of existing ERA for both watersheds. In the Whittles Upper Camp HUC 7 watershed, ERA from previous activities come from timber harvest on private lands. Currently, there are no known future foreseeable activities on either private or Forest Service lands outside of the Prather Medusa project at the HUC 7 watershed scale that would influence ERA. For the Whittles Upper Camp HUC 7 watershed, ERA increases steadily at the start of project implementation in 2021 and reaches its maximum of 8.75 percent in 2025, then decreases and reaches a minimum value of 4.82 percent in 2030 at the end of the 10-year analysis period (Table 4). While 63 percent of this watershed is proposed for treatment, ERA values remain below the threshold of concern of 10 to 12 percent throughout the 10-year period analyzed. In the Ganns HUC 7 watershed, ERA from previous activities come from timber harvest on both private and Forest Service lands. Current and future activities include STF's Hemlock project on the other side of the Stanislaus River canyon. For the Ganns HUC 7 watershed, ERA increases slightly at the start of project implementation in 2021 and reaches its maximum of 3.52 percent in 2023 before slowly decreasing to a minimum of 2.11 percent in 2030, the end of the 10-year analysis period (Table 3.2-2). At peak ERA, the Hemlock project accounts for a much higher proportion of total ERA (36 percent) than the proposed action (12 percent). Within the Ganns watershed, the proposed action has a relatively minor influence on ERA values which remain well below the threshold of concern throughout the analysis period.

In summary, cumulative effects estimated by the ERA modeling indicate that estimated CWE for the proposed action are below the threshold of concern of 10 to 12 percent for both HUC 7 project watersheds (Whittles Upper Camp and Ganns) throughout the 10-year period analyzed (Table 5).

Table 17 CWE-ERA Summary for HUC 7 Watersheds in the Project Area

Hydrologic Unit Code (HUC) Name	Annual Percent ERA									
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Whittles Upper Camp HUC 7	3.38	4.88	6.60	8.17	8.75	8.19	7.50	6.73	5.84	4.82
Ganns HUC 7	2.69	3.03	3.52	3.32	3.10	2.91	2.69	2.50	2.32	2.11

As stated above, watershed conditions were assessed through the SSI field surveys in 2009. General field observations have also been made since that time. Although field data from 2009 are

over a decade old, watershed conditions are unlikely to have changed considerably given that no large, landscape-level disturbances have occurred (e.g., large wildfire, widespread logging on private lands) that would invalidate the general findings of the original field assessment. Additionally, since 2009 several restoration projects have been implemented that have contributed to improving watershed conditions. Conditions have improved in SAFs that have been fenced from livestock disturbance. Channel and floodplain function have improved in Big Rattlesnake Creek since the removal of a culvert in 2013 that was impeding downstream bedload sediment movement. Available field data indicate project area watershed conditions are generally good overall and do not show evidence of existing cumulative effects and, therefore, are not at elevated risk of experiencing adverse CWE as a result of the proposed action.

If the project were not implemented, ERA would not be increased in the CWE HUC 7 analysis watersheds because project activities would not occur; therefore, risk of adverse cumulative effects would not increase and would remain low. However, without the proposed action, fuels reduction objectives would not be met because heavy fuel loadings would not be treated and would continue to pose an increased risk of future high severity wildfire and its attendant effects on watershed health.

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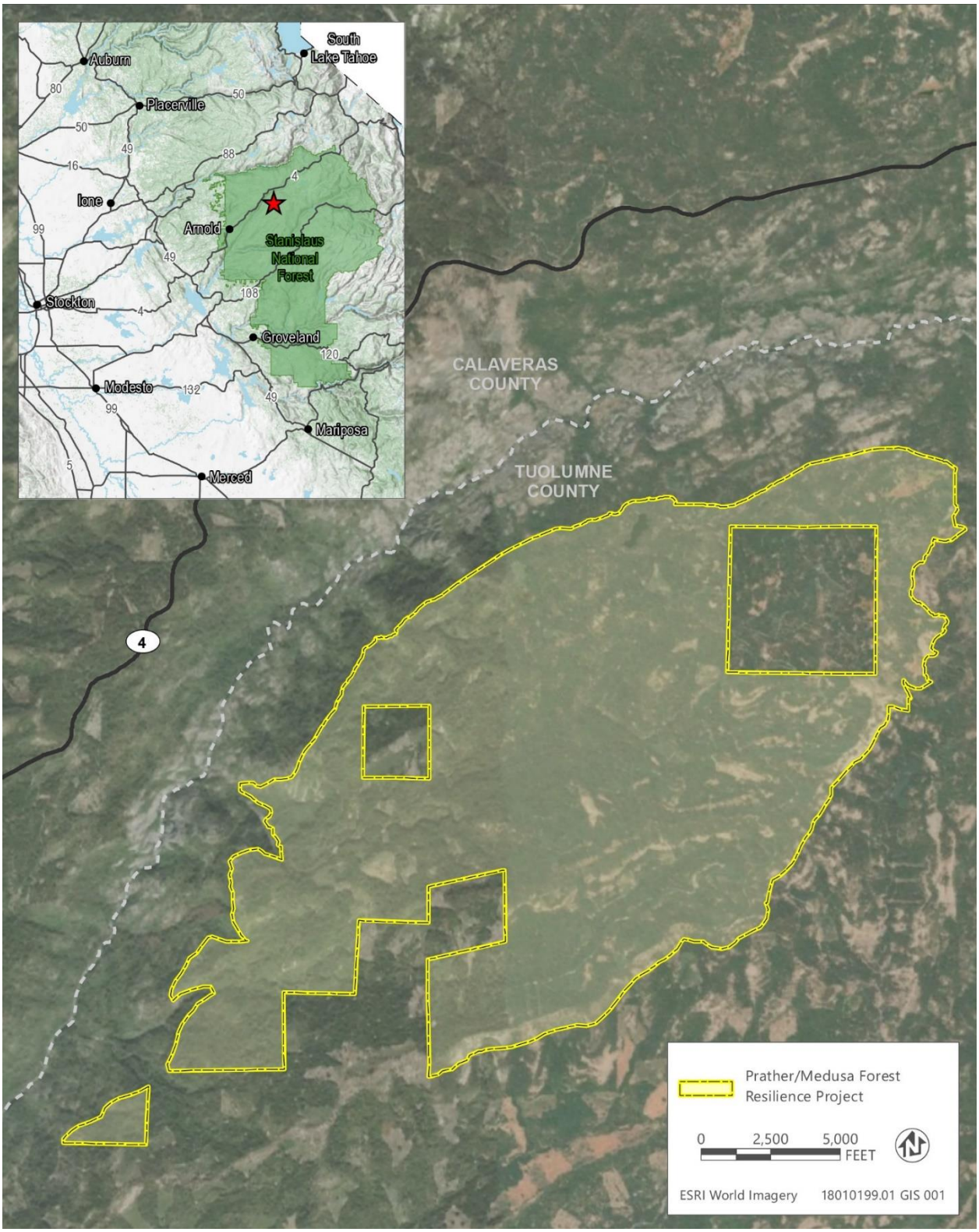
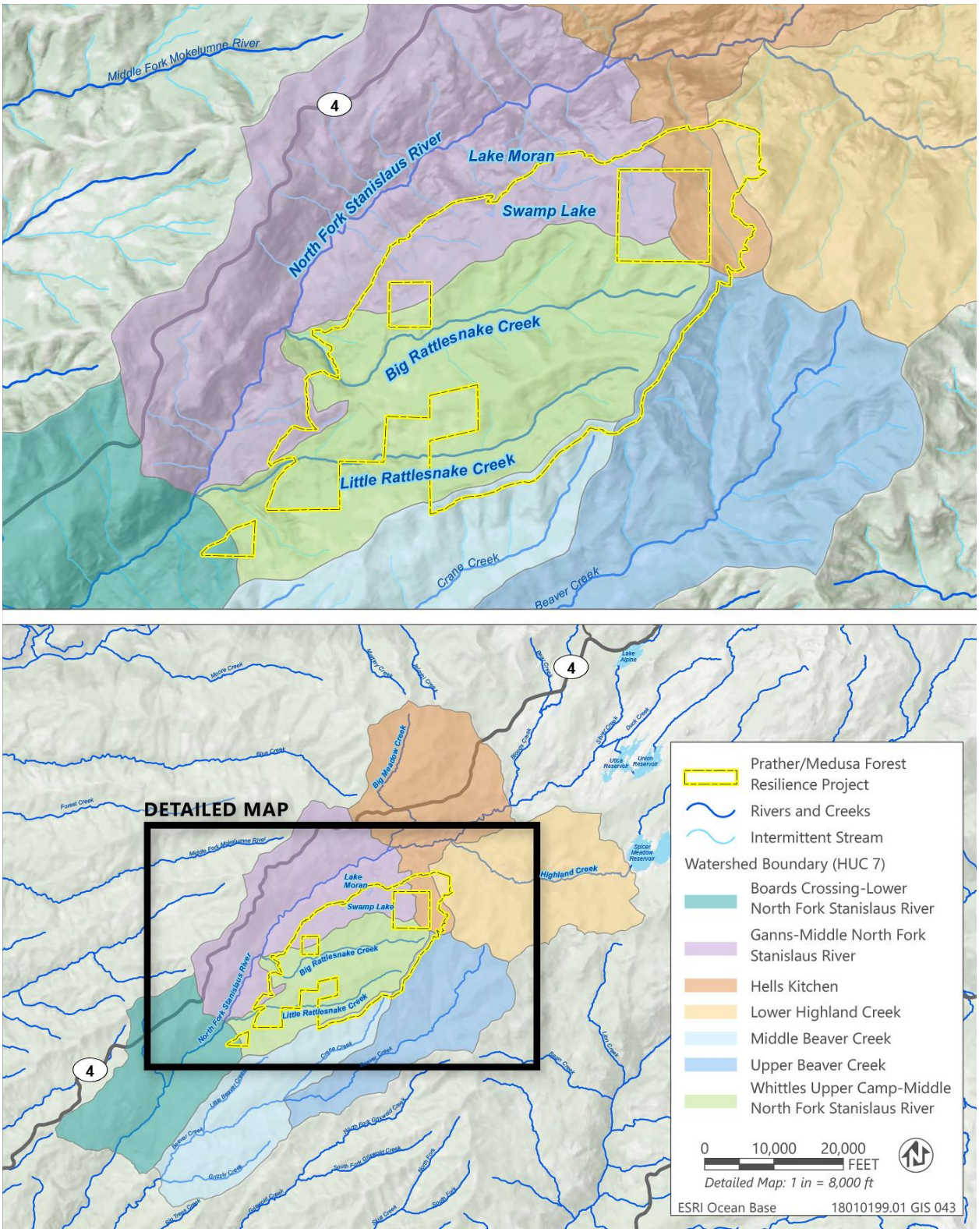
Appendix A

Maps



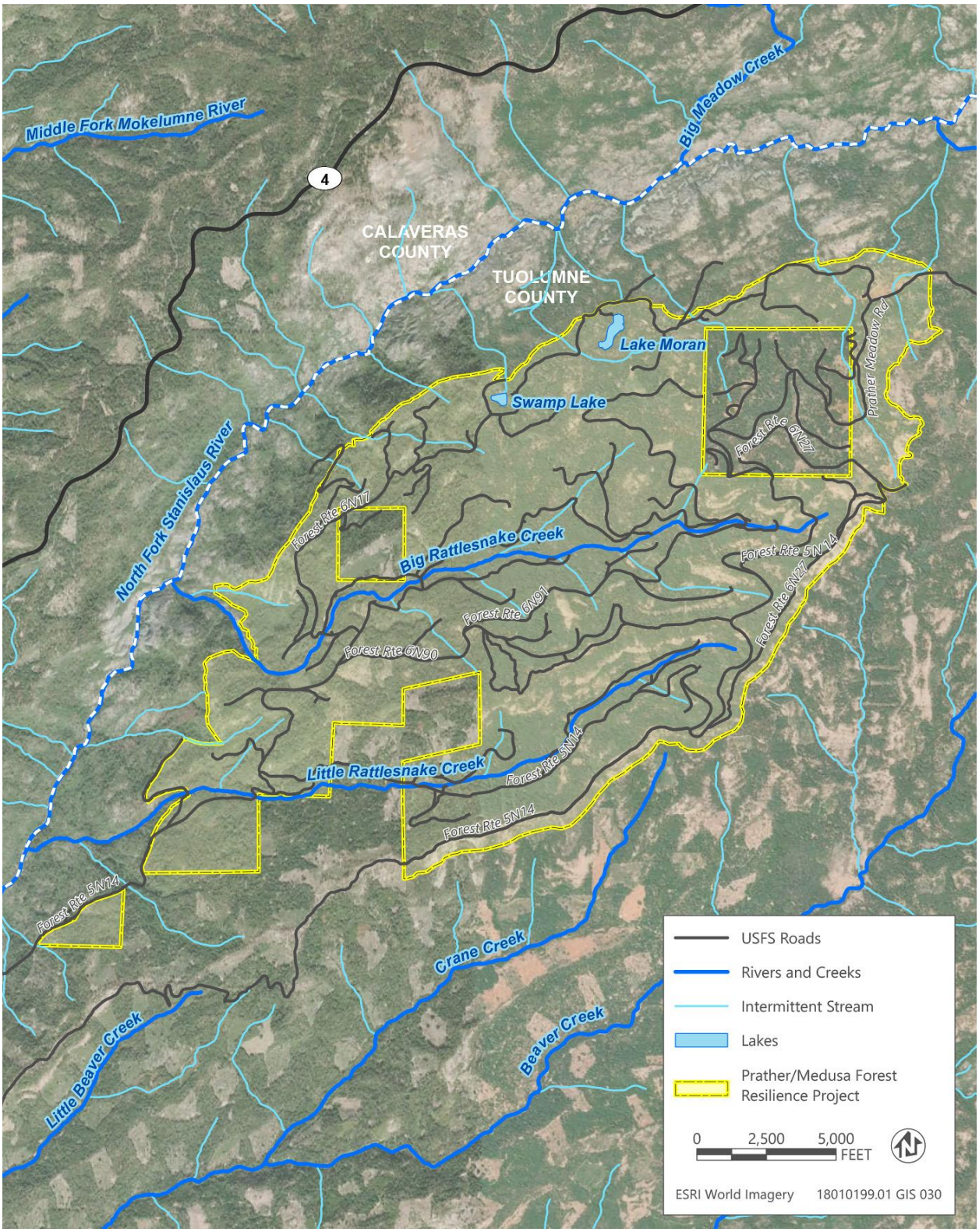
Source: Adapted by Ascent Environmental in 2019

Figure 1 Prather/Medusa Forest Management Project



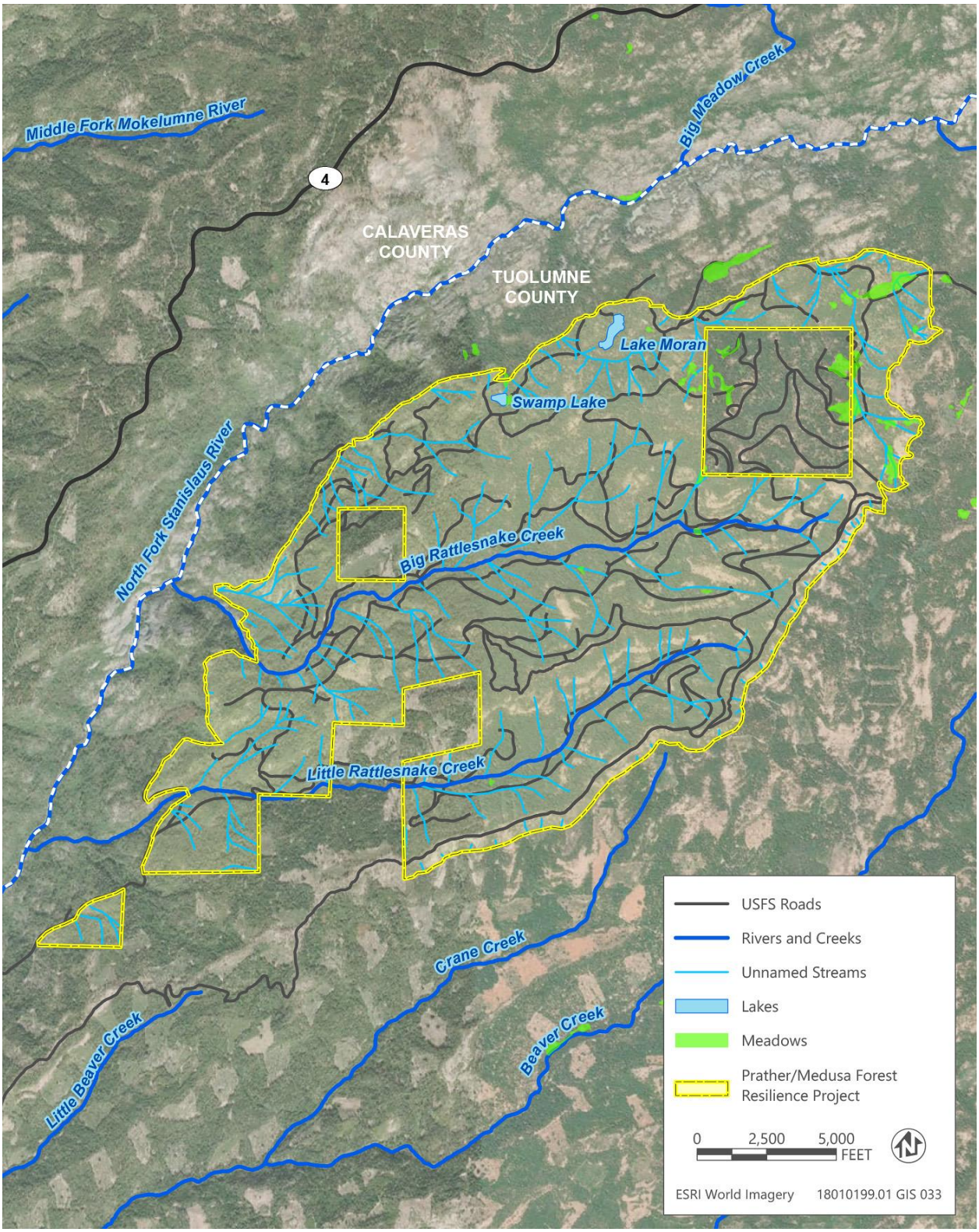
Source: Adapted by Ascent Environmental in 2019

Figure 2 Watershed Boundary - Prather/Medusa Forest Management Project



Source: Data received from Forest Service in 2019

Figure 3 Hydrology - Prather/Medusa Forest Management Project



Source: Adapted by Ascent Environmental in 2019

Figure 4RCA - Prather/Medusa Forest Management Project

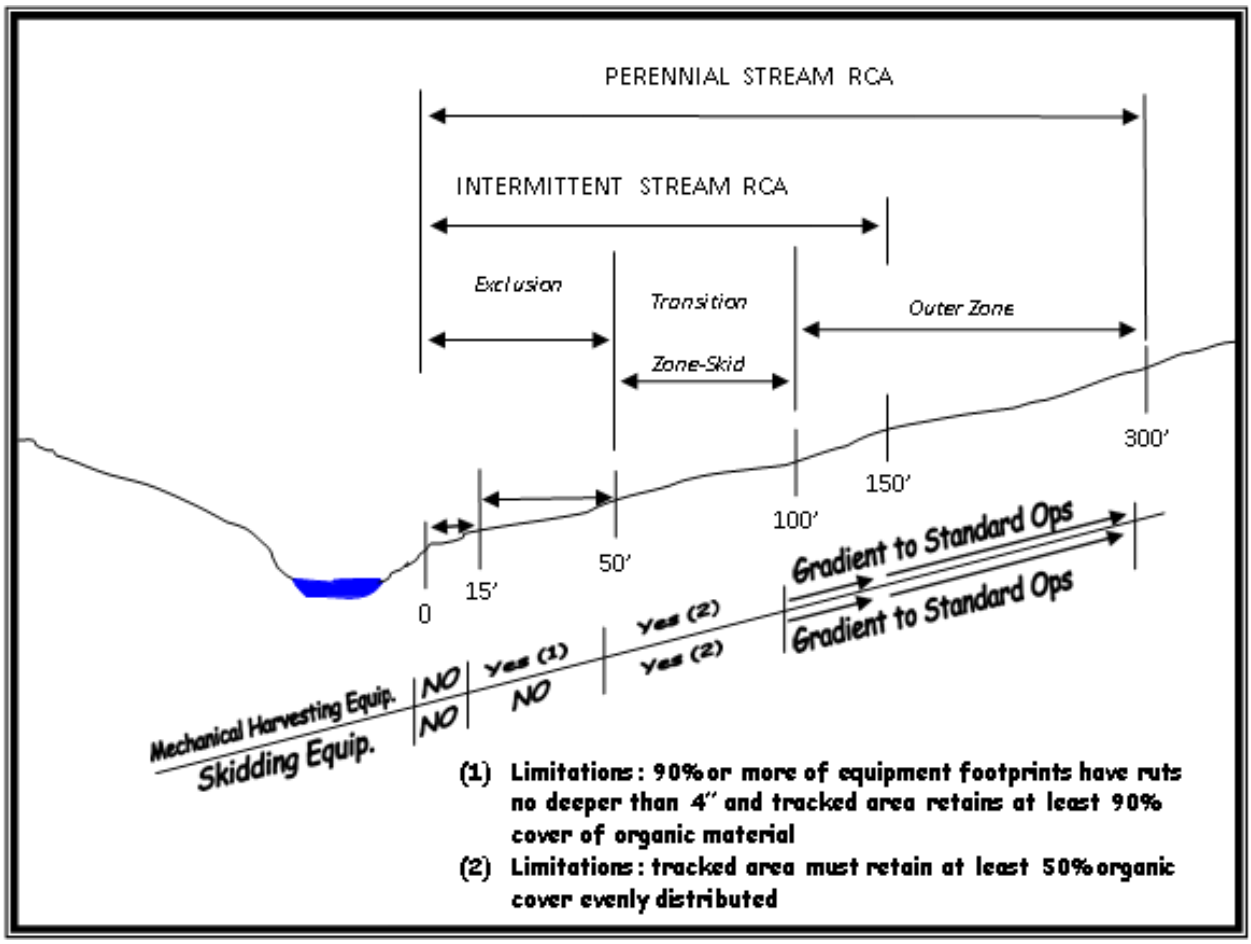


Figure 5 Mechanized Equipment Operation in Perennial and Intermittent RCAs

Appendix B

Management Requirements for Hydrology Resources

SOIL AND WATER

Design Feature Number	Design Criteria Description	FSH Reference and RCO Standard and Guideline (if applicable)
SW-1	Activities within riparian conservation areas (RCAs) will follow the equipment and operating specifications in *Riparian Conservation Area Equipment and Operating Specifications* (see table below).	
SW-2	The following slope limitations apply to equipment use in implementing the Proposed Action: • Dozer piling will be limited to slopes less than 25 percent. • Skidding with rubber-tired or fixed track equipment will be limited to slopes less than 35 percent. • Low ground pressure tracked equipment will be limited to slopes less than 45 percent.	BMP 5-2: Slope Limitations for Mechanical Equipment Operation
SW-3	In locations within the project area where conditions limit suitability for the use of rubber-tired skidders, (e.g., in areas with slopes equal to or greater than 35 percent or shallow soils), the desired soil condition after treatment is to limit detrimental soil disturbance to less than 15 percent of the treatment area. Visual indicators of soil disturbance include removal of the forest floor (vegetative parts in various stages of decomposition above the soil surface), topsoil displacement, rutting, and soil compaction. Treatment options that will be applied to limit detrimental soil disturbance for lava caps, thin soil (limited rooting depth of about 25 inches deep), steep slopes (greater than 35 percent), and long skid distances in areas proposed for tractor logging are summarized in *Soil Conditions that Require Special Treatment Considerations*.	BMP 1.10: Tractor Skidding Design
SW-4	Soil cover will be retained in the following amounts and conditions: • 50% cover will be retained on slopes less than 35 percent. • 60% cover will be retained on slopes equal to or greater than 35 percent. • 70% cover will be retained in RCA transition zones.	BMP 5-4: Revegetation of Surface-disturbed Areas
SW-5	Ground-based equipment will only be operated on dry soil with soil strength and bearing capacity capable of supporting mechanical equipment.	BMP 5-2: Slope Limitations for Mechanical Equipment Operation
SW-6	In all aspen meadows and special aquatic features (SAFs; Includes lakes, meadows, fens, bogs, wetlands, vernal pools, and springs) with planned thinning operations, the	BMP 5.3: Tractor Operation Limitation in Wetlands and Meadows

Design Feature Number	Design Criteria Description	FSH Reference and RCO Standard and Guideline (if applicable)
	boundary of the RCA exclusion zone will be reviewed by a Forest Service soil scientist or hydrologist and mapped with a GPS.	
SW-7	Waste disposal areas will be designated before operations begin. Prohibited waste disposal areas include slopes with a high risk of mass failure, areas subject to overland flow (e.g., convergent areas subject to saturation), and RCAs. Excess or unsuitable materials will be deposited only in designated waste areas. Adequate surface drainage and erosion protection will be provided in waste disposal areas.	BMP 4-5: Control of Solid Waste Disposal
SW-8	Waste material from project activities will not be side cast into RCAs.	BMP 4-5: Control of Solid Waste Disposal
SW-9	Existing skid trails will be used wherever possible, except where unacceptable resource damage may result. Skid trails will be located a minimum of 50 feet from intermittent and ephemeral streams and SAFs and will be designed and situated to fit the terrain, volume, velocity, concentrations, and direction of runoff in a manner that minimizes erosion and sedimentation. When operations are complete, main skid trails and temporary roads will be subsoiled and waterbars and other erosion control features will be implemented on skid trails, as appropriate.	BMP 1-10: Tractor Skidding Design BMP 1-17: Erosion Control on Skid Trails
SW-10	Existing log landings will be used to the extent feasible. Where new log landings are required, they will be not be constructed within 100 feet of perennial or intermittent streams, or within 50 feet of ephemeral streams. All log landings will be covered with subsoil and stabilized when work is complete.	BMP 1-12: Log Landing Location BMP 1-16: Log Landing Erosion
SW-11	**Road Stabilization.** Road construction and maintenance activities will be scheduled during dry periods when the National Weather Service predicts zero percent chance of precipitation for at least 48 hours after implementation and stabilization of such activities. Project areas will be stabilized during the normal operating season when the National Weather Service predicts a 30 percent or greater chance of precipitation. Erosion control and stabilization measures will be installed before the start of the rainy season (November 16 through March 31). Stream crossings will be removed, rehabilitated, and stabilized before the rainy season, or following treatments, whichever is sooner. Project implementation will follow guidelines and restrictions identified in the STF wet weather operating guidelines. All areas will be stabilized with mulch, erosion fabric, vegetation, rock, organic matter, engineered structures, or other measures as stipulated in the Erosion Control Plan.	BMP 2-3: Road Construction and Reconstruction BMP 2-8: Stream Crossings BMP 2-13: Erosion Control Plans

Design Feature Number	Design Criteria Description	FSH Reference and RCO Standard and Guideline (if applicable)
SW-12	**Road Construction**. Road construction within the project area will be carried out according to the following provisions: • The minimum area of disturbance required to carry out road construction will be identified before commencing ground-disturbing activities, and the area will periodically be monitored by Forest Service personnel to ensure that disturbance remains confined to designated areas and that the area of disturbance can be adequately stabilized before wet periods (see SW-12). • Slash generated by road construction will be used as erosion-control ground cover material. • Road cut, fill, and spoil disposal areas will be constructed in a stable manner. Cut and fill slopes will not exceed the angle of repose, and slopes will be stabilized with ground cover as needed near streams to prevent soil erosion and sedimentation. • Cross drains (e.g., rolling dips, culverts, waterbars) will be designed and spaced to minimize erosion. • Road drainage outlets will be designed to discharge onto non-erodible materials such as natural vegetation, rock aprons, and/or other energy dissipators.	BMP 2-3: Road Construction and Reconstruction RCO 2-S&G# 100 RCO 4-S&G# 116
SW-13	**Road Maintenance**. Road maintenance within the project area will be carried out according to the following provisions: • Road surfaces will be maintained with uniform drainage along the road utilizing: ◤ rolling dips where outsloped (preferred method of drainage), ◤ drains where insloped, ◤ drains where crowned. • Surface drainage will be designed to minimize hydrologic connectivity and maximize infiltration and dissipation. • Ditches and drainage structures will be cleared the minimum necessary number of times to maintain functionality, and features such as swales, ditches, shoulders, and cut and fill slopes with accumulating vegetation will be cleared. • Diversion prevention dips will be installed and armored where necessary.	BMP 2-4: Road Maintenance and Operations BMP 2-13: Erosion Control Plan (roads and other activities) RCO 2-S&G# 100 RCO 4-S&G# 116

Design Feature Number	Design Criteria Description	FSH Reference and RCO Standard and Guideline (if applicable)
	• Erosion control devices will be installed when conducting maintenance activities on hydraulically connected roads. • Seeps and springs will be diverted across roads and treated with erosion control if necessary. • Road maintenance activities will adhere to the road stabilization measures described above.	
SW-14	**Borrow Sources**. If new borrow sources are required for road construction or maintenance, topsoil at the source will be removed and stockpiled for use as surface dressing in post-operation site rehabilitation. After operations are complete, the site will be rehabilitated and stabilized using the following steps: • Grade side slopes to ensure proper drainage • Smooth and stabilize pit area • Spread fine material over the bottom of the pit • Apply stockpiled or imported topsoil Seeding, soil amendments and mulching may be required for decommissioning. Installation of sediment basins and/or upslope diversions and berms or other sediment reduction measures will be considered. Temporary access roads to borrow sites will be decommissioned. System roads to quarries or borrow pits will be maintained.	BMP 2-7: Road Decommissioning BMP 2-12: Aggregate Borrow Areas BMP 2-13: Erosion Control Plan
SW-15	**Prescribed Fire.** Damage to obligate riparian vegetation (e.g. willows, alders, cottonwoods) will be avoided during project implementation. A minimum of 75 percent ground cover will be retained within 100 feet of perennial streams and 50 feet of intermittent streams. (Ground cover is defined as a minimum of one inch of organic litter, slash, duff, or loose rock fragments, as well as living vegetation less than five feet tall.) Direct ignition will not be done in RCAs; however, fire may back into the riparian area if ground cover is maintained. Fire lines will not be constructed in RCAs unless there is no alternative. New dozer lines will not be constructed within 100 feet of perennial and intermittent streams and 50 feet of ephemeral streams. Constructed fire lines will be restored upon completion of prescribed burning and/or before each winter. Restoration shall consist of water barring hand and dozer lines, re-contouring of benched trails, and subsoiling of detrimentally compacted dozer lines.	BMP 6-2: Consideration of Water Quality in Formulating Fire Prescriptions BMP 6-3: Protection of Water Quality from Prescribed Burning Effects

Design Feature Number	Design Criteria Description	FSH Reference and RCO Standard and Guideline (if applicable)
SW-16	Burn piles will be located a minimum of 50 feet away from perennial and intermittent streams and 25 feet from ephemeral streams. Piles will be located outside of areas that receive runoff from roads.	BMP 6-2: Consideration of Water Quality in Formulating Fire Prescriptions BMP 6-3: Protection of Water Quality from Prescribed Burning Effects
SW-17	Access roads will be watered as needed to prevent dust during hauling.	BMP 2-5: Water Source Development and Utilization
SW-18	**Water Sources**. The following provisions apply to water sources used for road watering and fuel treatment activities: • The use and/or installation of permanent water sources, such as piped diversions to a storage location, will be used, wherever possible, in preference of temporary water source developments. Water drafting intakes will be located to avoid adverse effects to in-stream flows and depletion of pool habitat. Storage basins will not be constructed at culvert inlets as such placement can accelerate blockage of the culvert. • Fish passage will be provided where temporary dams are installed on fish-bearing streams to create a drafting pool. Temporary dams will be removed when operations are complete in a manner that does not cause sedimentation of the waterway. When diverting water from streams, bypass flows shall be maintained that ensure continuous surface flow in downstream reaches and keep habitat in downstream reaches in good condition. • Access approaches will be oriented as close to perpendicular as possible to prevent stream bank excavation. • Road approaches and drafting pads will be treated to prevent sedimentation and will be armored from the end of the approach to a stream to the nearest of: ◤ 50 feet, ◤ the nearest drainage structure, ◤ the nearest distance that water drains away from the watercourse. • Areas subject to high flood events will be armored to prevent erosion and sedimentation of waterways.	BMP 2.5: Water Source Development and Utilization BMP 2-13: Erosion Control Plan RCO 2-S&G# 101 RCO 4-S&G# 110

Design Feature Number	Design Criteria Description	FSH Reference and RCO Standard and Guideline (if applicable)
	• Water drafting pumps with a low entry velocity will be used to minimize removal of aquatic species (such as juvenile fish, amphibian egg masses and tadpoles) from aquatic habitats. Screening devices will be applied to water drafting pumps. • For fish-bearing streams, the water drafting rate should not exceed 350 gallons per minute for streamflow greater than or equal to 4.0 cubic feet per second (cfs). Below 4.0 cfs, drafting rates should not exceed 20 percent of surface flows. Water drafting should cease when bypass surface flows drop below 1.5 cfs. • For non-fish-bearing streams, the water drafting rate should not exceed 350 gallons per minute for stream flow greater than or equal to 2.0 cfs. Drafting rate should not exceed 50 percent of surface flow for non- fish-bearing streams. Water drafting should cease from non-fish-bearing streams when bypass surface flow drops below 10 gallons per minute.	
SW-19	All water-drafting vehicles will be checked daily and repaired as necessary to prevent leaks of petroleum products from entering RCAs. Water-drafting vehicles will contain petroleum-absorbent pads and be placed under vehicles before drafting. Water- drafting vehicles shall contain petroleum spill kits. Absorbent pads will eb disposed of according to the Hazardous Materials Response Plan.	BMP 2-5: Water Source Development and Utilization
SW-20	**Servicing and Refueling Equipment**. The following provisions apply to the use of combustion equipment used in implementing project activities: • Temporary refueling and servicing will be allowed only at approved sites located outside of RCAs. • A current Spill Prevention and Containment and Counter Measures (SPCC) plan is required where total oil products on site in above-ground storage tanks exceed 1320 gallons or where a single container exceeds 660 gallons. • Contour berms and trenches will be installed around vehicle service and refueling areas, chemical storage and use areas, and waste dumps. Ground liners will be used to prevent seepage to groundwater. • Spills will be reported, and appropriate clean-up action initiated in compliance with state and federal laws and regulations. The forest hazardous materials coordinator's name and phone number will be available to Forest Service personnel who administer or manage activities utilizing petroleum-powered equipment.	BMP 2-11: Equipment Refueling and Servicing RCO 1-S&G# 99

Design Feature Number	Design Criteria Description	FSH Reference and RCO Standard and Guideline (if applicable)
	• Contaminated soil and other material will be removed from National Forest System lands and disposed of in compliance with controlling regulations.	
SW-21	**Stream Crossings**. Streambank disturbance at crossings will be kept to a minimum, and any disturbance will be stabilized and mitigated. The number of stream crossings will be kept to the minimum necessary to access the site. Ford crossings will be armored with boulder-sized or larger rock fill at entry and exit points. Base material for rock fill will be clean rock, 6 inches or larger in size, with smaller running course if needed. Excess material from the installation of culverts and stream crossings will be disposed of in a manner such that it will not reenter the stream channel. Culverts and stream crossings will be designed so that they do not create a barrier to passage for aquatic species that may be present at the site.	BMP 2-8: Stream Crossings RCO 2-S&G# 100, 101
SW-22	Borate compound will not be applied within 10 feet of surface water when the National Weather Service predicts a 30 percent or greater chance of precipitation, or during precipitation. Applicators will follow all state and federal laws and regulations regarding the application of herbicides.	BMP 5-7: Pesticide Use Planning Process BMP 5-8: Pesticide Application According to Label Directions and Applicable Legal Requirements BMP 5-11: Cleaning and Disposal of Pesticide Containers and Equipment BMP 5-12: Streamside Wet Area Protection During Pesticide Spraying

Table 1. Riparian Conservation Area Operating and Equipment Specifications

Stream Type	Distance from RCA feature (ft)	Allowed Equipment[1,2]	Resource Element	Operating Requirements
Perennial/SAF[3]/ Intermittent	0-15	Mechanical Harvest/Shred: Prohibited Hand Treatments: Allowed	General	No mechanical entry Trees must be felled away from stream and removed by cable
	0-50	Skidding: Prohibited	General	No skidder entry Trees must be felled away from stream and removed by cable
	15-50	Mechanical Harvest/Shred: Allowed	General	Mechanical treatments allowed only when using tracked vehicles that exhibit low ground pressure.
			Soil Strength	Operate only when 90% of total tracked area is rutted <4 inches deep
			Soil Cover	Operate only when continuous ground cover is retained in 90% of the total tracked area
			Streamcourse Debris	Remove operations-created debris from stream channels
			Vegetation	Retain obligate riparian shrubs and trees (e.g. willows, alder, aspen)
	50-100	Skidding: Allowed	General	Mechanical treatments using rubber-tired skidders are allowed
			Soil Cover	Retain minimum 70% ground cover overall in transition zone Retain minimum 50% evenly distributed ground cover in areas traveled by tires or tracks
			Skid Trails	Use existing skid trails except where unacceptable impact would result. Do not construct new skid trails within 100 feet of stream
			Stream Crossings	The number of crossings should not exceed an average of 2 per mile.

Stream Type	Distance from RCA feature (ft)	Allowed Equipment[1,2]	Resource Element	Operating Requirements
	100-300	Mechanical Harvest/Shred: Allowed Skidding: Allowed	Skid Trails	Density and intensity of skid trails will gradually increase as distance increases from the Transition Zone
			Soil Cover	Approximately 40% ground cover must be maintained in this zone
	100-150	Mechanical Harvest/Shred: Allowed Skidding: Allowed	Skid Trails	Density and intensity of skid trails will gradually increase as distance increases from the Transition Zone
			Soil Cover	Approximately 40% ground cover must be maintained in this zone
			Vegetation	All trees that have their root system incorporated into the integrity of the stream bank would be retained
Ephemeral	0-15	Mechanical Harvest/Shred: Prohibited		
	0-25	Skidding: Prohibited		
	15-25	Mechanical Harvest/Shred: Allowed		
	25-50	Mechanical Harvest/Shred: Allowed Skidding: Allowed	Soil Cover	Retain minimum 50% evenly distributed ground cover in areas traveled by tires or tracks
			Skid Trails	Use existing skid trails except where unacceptable impact would result. Do not construct new skid trails within 50 feet of stream
			Stream Crossings	The number of crossings should not exceed an average of 3 per mile.

1. Mechanical harvesting and shredding equipment includes track-laying machines with an articulating arm that have an operational radius of a minimum 20 feet, such as feller-bunchers and masticators.

2. Skidding equipment includes rubber-tired skidders and track-laying tractors.

3. SAF = Special Aquatic Features. Includes lakes, meadows, fens, bogs, wetlands, vernal pools, and springs.

Table 2. Soil Conditions that Require Special Treatment Considerations

Soil Condition				Treatment	
Lava caps	**Thin soils**	**Steep slopes (>35%, high displacement)**	**Long skid distances**	**No.**	**Specification**
		X		(1)	Keep rubber-tired skidders on slopes <35%, end-line short, steep pitches (>35% and less than 100 feet)
	X	X	X	(2)	Exclude from treatment difficult to reach areas that would require skid trails on slopes >35%
		X		(3)	Use a feller-buncher to pack trees to slopes <35%. This option may not work for larger trees. Operational limit of feller-buncher varies from 40-45% slope, depending on soil and bedrock type. Special equipment (e.g. excavator) may be required.
	X	X	X	(4)	Ariel harvest where topography is favorable, and a considerable portion of unit is steep (>35%).
		X		(5)	Use fixed track grapple skidders on steep pitches (>35%). Recontour displaced soil. Special equipment (e.g. excavator) may be required.
	X	X	X	(6)	Flexible track (low ground disturbance) skidders may be used to yard biomass or sawlogs on 35-45% slopes (<35% where soils are thin), or where adverse skidding is necessary.
	X	X	X	(7)	Use cut-to-length equipment where long skidding distances are necessary; where thin soils or low nutrient soils are present over considerable acreage; or in plantations where soil quality is a concern.
		X	X	(8)	Use a hybrid ground-based/aerial system. The harvester or feller-buncher cut trees to be removed by aerial yarding. Operational limit of feller buncher varies from 40-45% slope, depending on soil and bedrock type.
X	X	X	X	(9)	Log over snow operations
X				(10)	No ground disturbance
	X	X		(11)	Coordinate with soil scientist on layout for treatment numbers (2), (3), (5), and (8)